ROLE OF eTEP APPROACH IN VENTRAL HERNIA REPAIR

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Dedicated

to

my family

&

Teachers

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ABBREVIATIONS

ASA –	American Society of Anesthesiologists
AWR-	Abdominal Wall Reconstruction
CLD -	Chronic Liver Disease
eTEP -	Extended view totally extraperitoneal repair
IPOM -	Intraperitoneal onlay mesh repair
MRSA -	Methicillin resistant Staphylococcus aureus
NPO -	Nil Per Oral
ePTFE -	expanded Poly Tetra Fluoro Ethylene
RS -	Rives Stoppa technique
TAPP -	Transabdominal Preperitoneal repair
TAR -	Transversus Abdominis Release
TEP -	Totally extraperitoneal repair
VAS -	Visual Analog Scale

ABSTRACT

Introduction: The extended view totally extraperitoneal approach (eTEP) is a novel approach for repair of ventral and incisional hernia wherein we place the mesh in the retrorectus space instead of intraperitoneal placement. There is rapid and easy creation of extraperitoneal domain with large operative space and flexible port set up and improved tolerance of pneumoperitoneum.

Aim of Study: To study the efficacy, safety, outcome, cost effectiveness and complications of eTEP approach in ventral hernia repair

Materials & Methods: A prospective time bound observational and descriptive study of 52 patients who underwent eTEP repair of ventral and incisional hernia between 1st November 2018 to 31st March 2020 at DMCH Ludhiana were included in this study. Patients with defect size less than 6 cm underwent Rives Stoppa method of eTEP repair whereas those with defect size greater than 6 cm were operated by the Transversus Abdominis Release method.

Result – In our study on 52 patients with ventral and incisional who were operated by the eTEP approach, 33 were males and rest 19 females, 27 patients had ventral and 25 patients had incisional hernia. Only one case had to be converted to open in view of inadvertent enterotomy made intraoperatively, post op seroma formation was seen in two cases which was managed conservatively, no patient developed surgical site infection, no recurrence was recorded in our study at minimum follow up of 3 months duration. There was significant reduction in chronic pain postoperatively and it was seen in 6 patients which was mild and relieved with oral analgesic.

Conclusion – In our study on 52 patients operated by the eTEP approach for repair of ventral and incisional hernia, we conclude that it is a safe approach with fewer complications, better outcomes, cosmesis and cost effectiveness. Extaperitoneal placement of mesh avoids serious bowel complications like enterocutaneous fistula formation. Significant reduction in post operative pain, hernia recurrence rates besides the shorter learning curve for the young surgeon make this an attractive treatment approach for repair of ventral and incisional hernia worldwide.

Keywords: Abdominal wall reconstruction, Enhanced-view totally extraperitoneal technique, Retromuscular mesh placement, Transversus abdominis release, Ventral and incisional hernia repair.

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INTRODUCTION

Any abnormal protrusion of viscus through the cavity containing it is defined as a hernia. Hernias commonly present with complaints of swelling along with pain and discomfort over the swelling. Sometimes the patient may present in obstruction when the contents get obstructed which is commonly seen in hernias with narrow neck. Diagnosis is mostly clinical. Radiological tests like ultrasound scan and computed tomography is done to check the defect size and for planning the surgery. Ventral and incisional hernia are a challenging problem for surgeons as these are notorious for recurrence besides other common complications like post op chronic pain, seroma formation and surgical site wound infection. It has been observed that the incidence of incisional hernia is on the rise. As many as 10-50% patients after laparotomy develop an incisional hernia worldwide.[1] Many different techniques have been developed for the repair of incisional hernia because of unacceptably high recurrence rates worldwide. Despite best efforts there has been no single technique which can overcome the challenges of ventral and incisional hernia repair.[1]

Before the 1990s ventral and incisional hernia were repaired exclusively by open approaches. Chronic pain, mesh sensation, seroma formation and recurrence are some of the common problems encountered postoperatively. Later in the 1990s pioneers like LeBlanc started using the laparoscopic approach, which were soon found to be associated with advantages like early post op ambulation, shorter duration of hospital stay, minimal post op pain, earlier return to work and less post op wound infections.[2] Chronic pain and movement limitations are among the main complaints of hernia patients, promoting a cycle of inactivity, weight gain, and progressive loss of function. Despite best efforts and modern advances there is still no best method for hernia repair. Mesh infections have also been reported to be less in laparoscopic approaches as compared to open approach. Initially the IPOM (i.e. intraperitoneal onlay mesh repair) in which the

hernia contents are reduced after entering the peritoneum and the defect repair and mesh placed intraperitoneally, TAPP(Transabdominal preperitoneal) repair in which we enter the peritoneal cavity and then proceed into the preperitoneal space for hernia repair and mesh placement, and TEP (Totally extraperitoneal) repair in which dissection is done exclusively in the extraperitoneal space and peritoneum is not breached at all, were the approaches used in laparoscopic repair of vental and incisional hernia. eTEP (extended view Totally Extra Peritoneal) repair is a novel approach in repair of ventral and incisional hernia. It was initially devised for inguinal hernia and was found to be particularly beneficial in obese patients, patients with short distance between umbilicus and pubic symphysis. It has a number of advantages over the conventional laparoscopic approaches for hernia repair.[2]

Mesh is placed in the retrorectus space in the extraperitoneal plane. The retrorectus space is a well vascularised space, because of its excellent arterial supply, where the mesh becomes incorporated. This also avoids the need for dual biological mesh which are much more expensive and which are used in intraperitoneal onlay mesh repair of hernia. Thus a normal polypropylene mesh, which is cheap can be easily used in eTEP approach. The need for penetrating fixation of mesh using tackers is avoided. This reduces the complication of chronic pain.[2]

Complications like entero cutaneous fistula, adhesive bowel obstruction etc are also thus avoided as the mesh is placed in extraperitoneal space. In this observational and descriptive study we aim to show the outcomes of ventral and incisional hernia repair by the eTEP repair in terms of intra-operative complications, post-operative complications like pain, recurrence etc. and overall cost effectiveness of the technique as compared to other minimally invasive approaches.

AIMS AND OBJECTIVES

To study the efficacy, feasibility, cost effectiveness, duration of hospital stay, outcomes and complications like post op pain, seroma formation surgical site infection, and recurrence following eTEP repair of ventral and incisional hernia.

REVIEW OF LITERATURE

Before 1990s, ventral hernias were repaired exclusively through the open approaches. Bigwigs and pioneers in the field of hernia surgery like LeBlanc, Booth, Heniford, Park, Ramshaw, and Voeller then described the laparoscopic approaches for ventral hernia repair (LVHR), wherein a barrier mesh is placed in the intraperitoneal underlay position.[1,2] This repair relies on wide mesh overlap, penetrating fixation with tacks and trans abdominal stitches without defect closure. Soon the advantages of LVHR over the open approach became obvious, most notably, reduced wound complication rates and faster recovery. With time and experience, some surgeons began incorporating primary closure of the defect in LVHR.[3] The decision to close the primary fascial defect at the time of hernia repair is gaining support due to assumed restoration of the anatomy, physiology, and cosmesis of the abdominal wall.[4,5] The laparoscopic ventral hernia repair has its shortcomings which include serious complications like adhesive bowel obstruction, mesh erosion, and enterocutaneous fistula resulting from direct contact between the mesh and intraperitoneal viscera.[6,7] Later on the trans abdominal preperitoneal (TAPP) approach to ventral and incisional hernias was described.[8] This procedure has the challenge of elevating and closing thin peritoneal flaps. Belyansky et al. recently described laparoscopic Transversus Abdominis Release (l-TAR), a reconstructive technique restoring the linea alba with retromuscular mesh reinforcement. Similarly to TAPP repairs, l-TAR prevents direct mesh contact with viscera.[9] Despite early success, the intracorporeal closure of the defects was found to be challenging with traditional port placement lateral to linea semilunaris. The enhanced-view totally extraperitoneal (eTEP) technique was first described for laparoscopic inguinal hernia repair.[10,11] The main features are rapid creation of extraperitoneal domain, large operative space, flexible port set-up, and improved tolerance of pneumoperitoneum.[11] It's main purpose was for learning and mastering of the procedure by the young surgeons and for complicated

cases like large inguinoscrotal, sliding, incarcerated inguinal hernias, in obese or post-bariatric patients and patients with history of pelvic surgeries or a short distance between umbilicus and pubic tubercle. Incorporation of the mesh prosthesis is facilitated its placement in the very well vascularised retro-rectus space.[10,11]

SURGICAL ANATOMY OF ANTERIOR ABDOMINAL WALL [12-18] Flat muscles of abdomen & recti are arranged to form an elastic contractile layer around the abdominal cavity protecting its contents. The broad muscles cross each other by an arrangement designed to strengthen the abdominal wall and diminish the risk of ventral hernias between separated muscle bundles.[12] All the viscera are maintained in position by the tone of muscle, protecting the viscera from external injuries. Increased abdominal pressure helps in acts of micturation, defecation & vomiting. Anterior abdominal wall from outside to inside consists of

I) **SKIN** Langer's line runs in transverse direction. Incision parallel to Langer's line seems to heal with a narrower & more cosmetic scar because of minimal forces pulling the skin edges apart. Longitudinal or oblique incisions heal with comparatively broader scar because they cut across the line of tension.[13]

II) **SUPERFICIAL FASCIA** Below anterior superior iliac spine it has superficial fatty layer of Camper fascia and deep membranous layer of Scarpa. There is no deep fascia in abdomen in order to facilitate movements of respiration.[14]

III) **MUSCLES** Three pairs of broad flat muscles

a) External oblique muscle: It originates from lower ribs and courses downwards and forwards medially inserts into iliac crest to public tubercle.[15]

b) Internal oblique muscle: It originates from lateral 2/3rd of inguinal ligament, iliac crest and intermediate lip of iliac crest and course opposite to external oblique muscle.

c) Transversus abdominis muscle: It originates from inguinal ligament, thoraco-lumbar fascia and the lower six ribs and inserts into conjoint tendon, forming an aponeurosis that merges with linea alba.

d) Rectus abdominis muscle: Two muscles lie edge to edge in the lower part but broader out above, and separated from each other by linea alba. Typically 3 intersections are found in the muscle at umbilical, xiphisternum and one between them. The muscles are formed by fusion of mesodermal somites indicated by regular segmental innervations. At tendinous intersection the fibers blend inseparably with the rectus sheath's anterior layer thus preventing retraction of rectus in transverse incisions. The muscles may be retracted laterally but not medially because of segmental nerves entering lateral border.[16]

IV) **RECTUS SHEATH**: It is a musculoaponeurotic sheath which envelopes the rectus abdominis and pyramidalis muscle on each side of line alba, acts as a retinaculum and prevents muscle from bow-stringing. The contents of rectus sheath include rectus abdominis muscle, pyramidalis muscle, inferior epigastric artery and vein, superior epigastric artery and vein, terminal parts of 7^{th} to 12^{th} subcostal nerves along with their collateral branches.[17]

V) **TRANSVERSALIS FASCIA**: It covers the deep surface of transversus abdominis muscle and forms a complete facial envelope around the abdominal cavity. This general fascia serves to bind together the muscle and aponeurotic fascia into a continuous layer and reinforce weak areas.

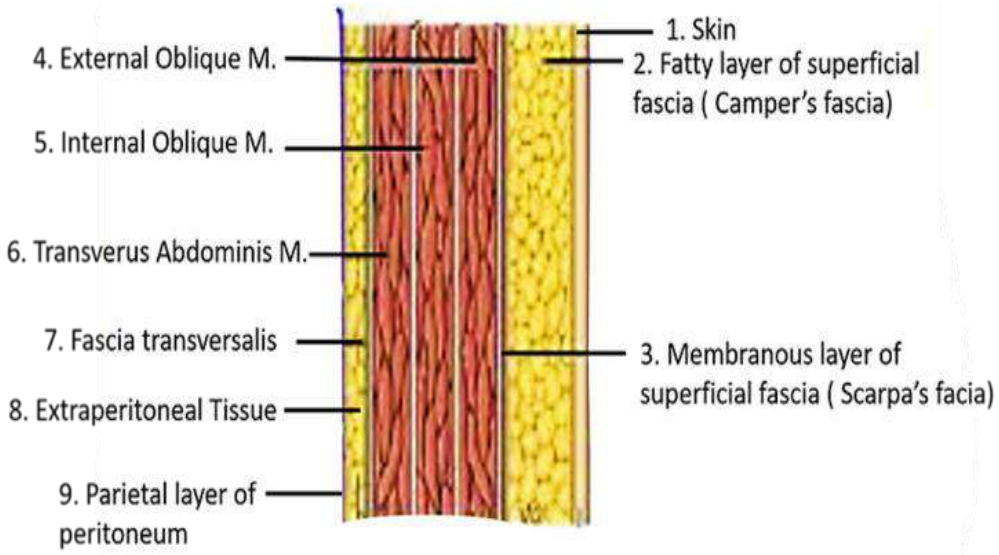
VI) **LINEA ALBA**: It is a strong midline fibrous structure between the two recti, produced by interlacement of aponeurotic fibers of three flat muscles of abdomen. It is attached to xiphoid above and public symphysis below, widened above the umbilicus (1 cm) but below the umbilicus it is difficult to recognize.

Nerve supply: Nerve supply of the anterior abdominal wall is segmental and related to specific spinal levels. The motor supply to the rectus abdominis muscles, the internal oblique, and the transversus abdominis muscles runs from the anterior spinal rami of the T6 to T12 levels.[18]

Blood supply: Superior epigastric artery and inferior epigastric artery are the major vessels which supply anterior abdominal wall. Subcostal

& lumbar arteries also contribute to the arterial supply of abdominal wall through its collateral branches.[18] Neurovascular bundles mainly lie in between the transversus abdominis and internal oblique muscle. Within rectus sheath, it passes between the posterior aspect of rectus abdominis muscle and posterior wall of rectus sheath.

Lymphatic drainage - The lymphatic drainage of the anterior abdominal wall is mainly to the major lymph nodes in the superficial inguinal and axillary regions. Area above the umbilicus is draining into axillary group of lymph nodes and the area below the umbilicus is draining into superficial inguinal lymph nodes.


1. Skin
2. Fatty layer of superficial fascia (Camper's fascia)
3. Membranous layer of superficial fascia (Scarpa's facia)
4. External Oblique M.
5. Internal Oblique M.
6. Transverus Abdominis M.
7. Fascia transversalis
8. Extraperitoneal Tissue
9. Parietal layer of peritoneum

VENTRAL HERNIA

A ventral hernia is a protrusion through the anterior abdominal wall fascia. These defects can be categorized as spontaneous or acquired or by their location on the abdominal wall. Epigastric hernias occur from the xiphoid process to the umbilicus, umbilical hernias occur at the umbilicus, and hypogastric hernias are rare spontaneous hernias that occur below the umbilicus in the midline. Acquired hernias typically occur after surgical incisions and are therefore termed incisional hernias.

Incidence

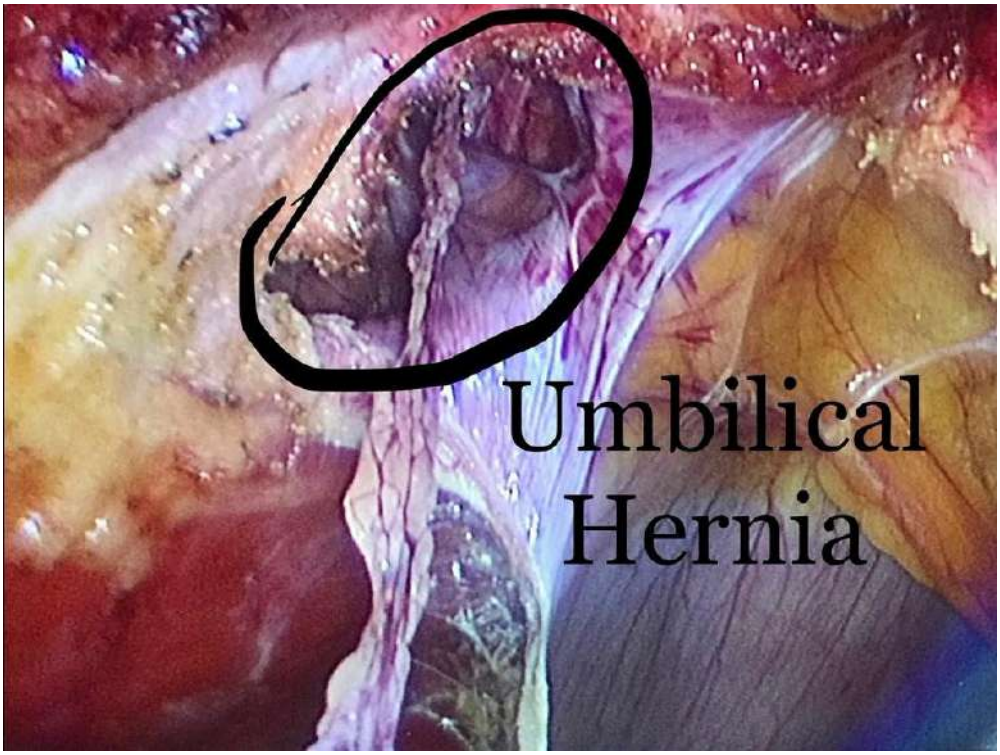
Based on western operative statistics, incisional hernias account for 15% to 20% of all abdominal wall hernias; whereas the umbilical and

epigastric hernias account for 10% of hernias.[19] Incisional hernias are twice more common in women than men. Some technical and patient-related factors have been linked to the occurrence of incisional hernias but there is no evidence showing the type of suture at the primary operation affecting hernia formation.[19] The use of a suture to wound length ratio of 4 : 1 has been shown to significantly reduce incisional hernia formation compared with the 1-cm bites and 1-cm advancement suturing technique typically employed by most surgeons.[20]

A study examining the incidence of ventral hernia formation after various abdominal incisions concluded that the risk is 10.5% for midline, 7.5% for transverse, and 2.5% for paramedian incisions.[21] A recently published trial reported higher wound infection rate in the transverse incisions.[22]

UMBILICAL HERNIA

Repair of umbilical hernia was first described by William Mayo's through his fascial overlap technique. These repairs are effective and may be the preferred technique for small umbilical hernias with no tension after fascial approximation but larger hernias have been reported to have a recurrence rate of up to 28%.[23] These tension free repairs which have been popularized for other ventral hernias have a role in umbilical hernia repair also. There is no difference in complication rates associated with mesh use however it definitely helps in reducing umbilical hernia recurrence. Laparoscopic techniques are used for umbilical hernias as well. The laparoscopic technique requires general anesthesia and is reserved for large defects or recurrent umbilical hernias.[24]



The technical aspects are the same as those applied for other ventral hernia defects. The laparoscopic approach takes longer to perform tends to have fewer complications and has lesser recurrences.[25] The disadvantages of the laparoscopic approach include the need for giving general anesthesia to establish pneumoperitoneum and increased length and the overall cost of operating time. Placement of trocars around but not through the umbilicus has the ability to overcome the wound related complications.[25] Small primary umbilical defects in low risk patients can be repaired with sutures alone and achieve acceptable results. Defects larger than 3 cm are closed using prosthetic mesh.[25]

Incisional hernia

Surgical repair of post incisional hernia abdominal wall defect can be a quite simple procedure or one of the most challenging operations a surgeon can face. Among all hernias, incisional hernias are the most difficult to treat. Incisional hernias occur due to excessive tension and inadequate healing of a previous incision, which may be associated with surgical site infection. These hernias increase over time, leading to pain, bowel obstruction, incarceration, and strangulation.[25] Obesity and overweight, old age, poor nutrition status, ascites, pregnancy, and

other factors that lead to an increase in the intra-abdominal pressure are factors that lead to the development of an incisional hernia.[18]

Primary repair of incisional hernias can be done when the defect is small in size (≤2 to 3 cm in diameter) and there is viable surrounding tissue or in cases in which the hernia was clearly a result of a technical error at the initial operation, such as a suture fracturing.[18]

Larger defects (>2 to 3 cm in diameter) have a high recurrence rate if closed primarily and are repaired with a prosthesis.[24] Recurrence rates vary between 10% and 50% and are typically reduced by more than 50% with the use of prosthetic mesh.[26]

Prosthetic Materials for Ventral Hernia Repair [17]

Synthetic materials Desirable characteristics of a synthetic mesh include it being chemically inert, resistant to mechanical stress while maintaining compliance, sterilizable, and noncarcinogenic.[27] Both polypropylene and polyester mesh have been successfully placed in the extraperitoneal position. Polypropylene mesh is a hydrophobic macroporous mesh that allows the in growth of native fibroblasts and incorporated into the surrounding fascia. Placing polypropylene mesh in an intra-peritoneal position directly in contact to the bowel wall is avoided because of high rates of enterocutaneous fistula formation.[27]

Recently, lighter weight polypropylene mesh has been brought into market to overcome long term complications of heavyweight polypropylene mesh. The lightweight meshes have an absorbable component of material that gives the stability of handling. Two prospective randomized trials evaluating the incidence of postoperative pain after open inguinal hernia repair have shown mixed results.[28] In a randomized controlled trial evaluating lightweight versus heavyweight polypropylene mesh for ventral hernia repair, the recurrence rate in the lightweight group was more than twice that in the heavyweight group (17% for lightweight mesh versus 7% for heavyweight mesh), which approached statistical significance (P = .052).[29,30]

Several studies have reported high rates of bacterial clearance with large-pore synthetic mesh when it is exposed to gastrointestinal flora and methicillin-resistant Staphylococcus aureus.[31-33] A study of 100

cases of large-pore polypropylene mesh used in clean contaminated and contaminated ventral hernia repairs was reported.[34]

Unprotected polyester mesh should not be placed directly on the viscera as high rates of erosion and bowel obstruction have been reported.[27] If it is placed in the preperitoneal position in complex ventral hernia repairs, complication rates are low.[35,36]

Biologic materials. Biologic prostheses for ventral hernia repair are non-synthetic, natural tissue mesh.[35]

These products are composed of acellular collagen and provide a matrix for neovascularisation. These products function best when used as a fascial reinforcement rather than as a bridge or interposition repair.[37] The long-term durability of biologic mesh has recently been questioned in the largest series of biologic mesh use in a contaminated setting.[38]

Operative

The benefit of keeping a large mesh with significant overlap under the muscular abdominal wall is understood by Pascal principles of hydrostatics, the intra abdominal cavity acts like a cylinder the pressure is evenly distributed to all aspects of the system, the forces that attempt to push the mesh through hernia defects, also hold the mesh in place against the intact abdominal wall. In this manner the prosthetic is held in place by the intra abdominal pressure.[37] The mechanical strength of the prosthetic prevents protrusion of the peritoneal cavity through the hernia because the hernial sac is indistensible against the mesh.

Various options for placing the mesh include the onlay technique which involves primary closure of the fascia defect and placement of a mesh over the anterior fascia. The advantage of this approach is that mesh is placed outside the abdominal cavity, avoiding direct interaction with the abdominal viscera.[38] Disadvantages include large subcutaneous dissection, greater chances of seroma formation, the superficial location of the mesh (which places it in jeopardy of contamination if the incision becomes infected), and the repair is usually under tension.[18] Prospective analysis of this technique is not available, but a

retrospective review has reported recurrence rates of 28%.[39] A sublay or underlay technique involves placing the prosthetic below the fascial components with recurrence rates < 4%.[39]

The mesh can be placed intra peritoneally, pre peritoneally, or in the retro rectus (retromuscular) space.

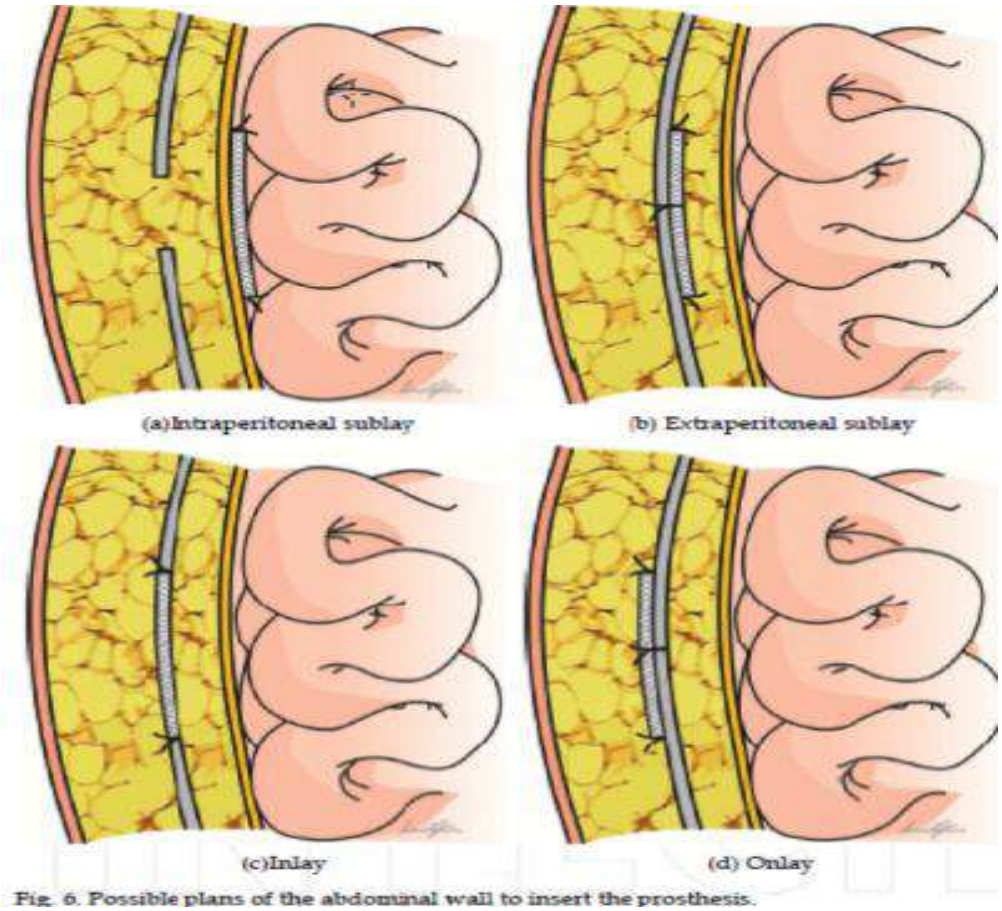


Fig. 6. Possible plans of the abdominal wall to insert the prosthesis.

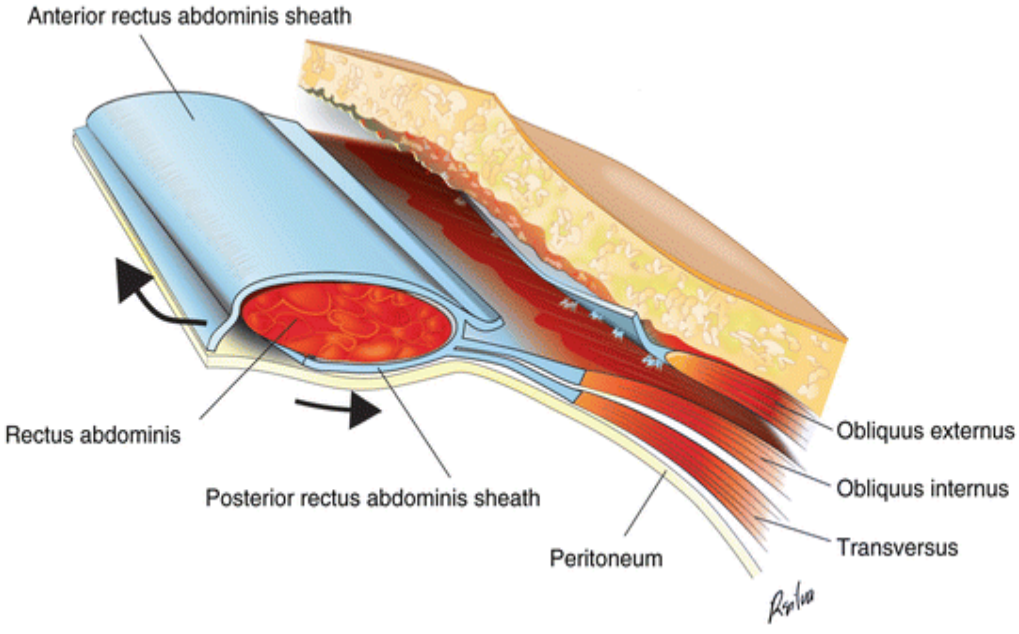
Intraperitoneal mesh placement Some principles of retrorectus prosthetic reinforcement have been adapted for laparoscopic ventral hernia repair. Instead of applying the mesh in a preperitoneal position an intraperitoneal underlay with wide coverage of the hernia defect is done. This technique also takes the advantage of Pascal principle of hydrostatics to provide a secure hernia repair.[35] Reopening of the prior incision and with the use of available dual-type mesh or composite mesh, the mesh can be placed in an intraperitoneal position at least 4 cm beyond the fascial margin and secured with interrupted mattress sutures. This technique requires raising subcutaneous flaps, and the mesh may be in direct contact with the abdominal contents.

Myofascial releases. One of the main principles of abdominal wall reconstruction is to re-establish the linea alba.

Restoring the linea alba to the midline provides the advantage of a functional abdominal wall, protects the mesh from superficial wound issues, and results in a stronger repair.[35]

Posterior rectus sheath incision with retromuscular mesh placement. This technique involves placing prosthetic mesh in the preperitoneal space.[35] This compartment is accessed by incising the posterior rectus sheath. The space is dissected laterally on both the sides of the linea alba at a distance of 8 to 10 cm from the defect.[35]

Posterior component separation. The retrorectus space is bordered laterally by linea semilunaris. Further advancement can be achieved by incising the posterior rectus sheath about 1 cm medial to the linea semilunaris. At this location, the posterior leaflet of the internal oblique and the transversus abdominis muscle are incised to make access in to the preperitoneal space. The plane can be extended to the retroperitoneum and then into psoas muscle.[40] Large sheets of prosthetic mesh can be placed in this location with wide defect coverage.[41] A review has documented a 5% hernia recurrence rate in 254 patients who underwent ventral hernia repair during a 13-year period.[28] Similar amount of fascial advancement was reported with a reduction in wound morbidity with use of the posterior approach.[41]



Anterior component separation. Another option for the repair of complex or large ventral defects is the anterior component separation technique (Figure) which involves separating the lateral muscle layers of the abdominal wall to allow their advancement.[42] Even though this technique often allows tension-free closure, recurrence have been reported with the use of prosthetic reinforcement in large hernias.[42] Small series of biologic mesh reinforcement of these repairs have been reported.[37] No comparative data exist demonstrating the superiority of either onlay or sublay repair technique.[43]

Endoscopic component separation. One of the major limitations of open component separation is that large skin flaps are necessary to access the lateral abdominal wall musculature. Recognizing these limitations, innovative, minimally invasive approaches to component separation have been described.[44] The basic principle of a minimally invasive component separation is to gain direct access to the lateral abdominal wall without creating a lipocutaneous flap. Typically, this is performed by a direct cutdown through a 1-cm incision off the tip of the 11^{th} rib overlying the external oblique muscle. The external oblique is split in the line of its fibers, and a standard bilateral inguinal hernia balloon dissector is placed in between the external and internal oblique muscles, toward the pubis.[43] Three laparoscopic trocars are placed in the space, the dissection is done from the pubis to several centimeters above the costal margin. The linea semilunaris is identified, and the external oblique is incised from beneath the muscle, 2 cm lateral to the linea semilunaris. The muscle is released from the pubis to several centimeters above the costal margin. This procedure is done bilaterally.

Incisional Hernia Repairs outcome Many prospective randomized trials have compared laparoscopic and open ventral hernia repairs.[45-49] Though most of the studies were small, with less than 100 cases, the observations tend to favor a laparoscopic approach for small to medium sized defects. The incidence of postoperative complications and recurrence was less in hernias that were repaired laparoscopically.[43] Laparoscopic incisional hernia repair results in

fewer postoperative complications, lower infection rate, and decreased hernia recurrence.[40,42-46,50]

Loss of Domain Hernias

Loss of domain is defined as a large hernia in which the herniated contents have resided for so long outside the abdominal cavity that they cannot be placed back into the peritoneal cavity easily. Typically loss of domain hernias are classified into patients with and without preoperative contamination.[18]

Patients with small hernia defect and a large hernia sac (e.g., large inguino-scrotal hernias) require restoration of peritoneal cavity domain, whereas patients with a large defect and a massive hernia sac (open abdomen with skin graft) require restoration of peritoneal domain and complex reconstruction of the abdominal wall.[18]

Before repair of these complex defects, the patient must undergo careful preoperative evaluation.

Weight control, smoking cessation, nutrition, and glucose control are necessary for abdominal wall reconstruction. Earlier, the techniques to stretch the abdominal wall gradually were done to allow the restoration of abdominal domain and aid in closure. This is done by insufflating air into the abdominal cavity to produce a progressive pneumoperitoneum. This technique is particularly suited for small defects and massive hernia sacs.[51]

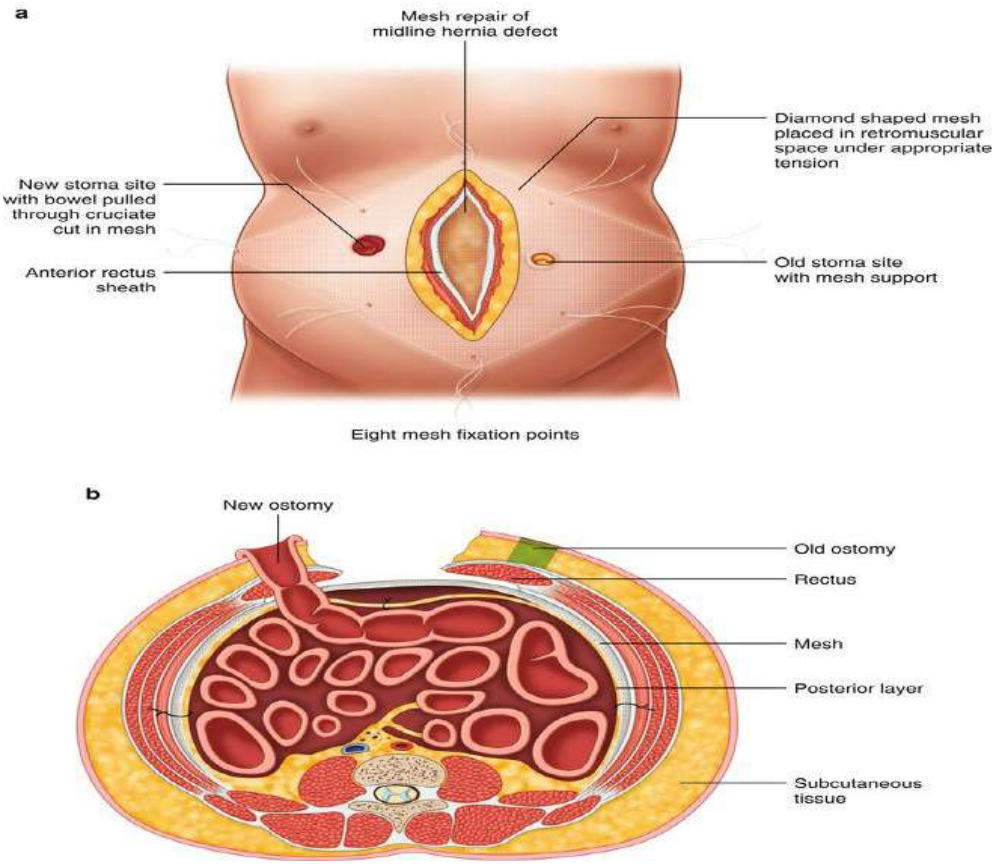
For larger defects a staged approach using ePTFE dual mesh for patients with loss of abdominal domain and lateral retraction of the abdominal wall musculature is used. The mesh is completely excised, the fascia is reapproximated with component separation and a biologic underlay patch.[52]

Parastomal hernia repair

Parastomal hernia is herniation of intestine on the side of the bowel stoma-ileostomy/colostomy/other stomas.[53] Three techniques for repair include primary repair of fascia, stoma replacement, and prosthesis repair. Primary fascial repair includes reduction of hernia and primary fascial reapproximation by peristomal incision. This technique has risk of recurrence. The benefit of this approach is that

the abdomen is not entered. Stoma relocation improves results; but it requires a laparotomy and predisposes to another parastomal hernia formation later in the future.[18] To decrease this risk of future herniation, some surgeons reinforce the repair with biological or synthetic mesh in a keyhole fashion around the new stoma site. initial results have shown promise, but long-term outcomes are not yet been reported.[53] The mesh may be kept in an onlay patch, intra-abdominally, or in the retrorectus position. In the Sugarbaker technique, the mesh is placed in an intraperitoneal position, a keyhole is made around the stoma site or placed as a flat sheet, lateralizing the stoma as it comes out of the abdomen.[54] Laparoscopic approaches for para stomal hernia repair have also been described.[55,56] A retro muscular repair has advantage of many of the advanced reconstructive techniques.

Laparotomy is performed, and the stoma is brought down and then re-positioned to the contralateral side of the abdomen. A posterior component separation is then performed; a large mesh is placed in the retromuscular space to cover the old stoma site and the entire midline incision, and it is used to prophylactically reinforce the new stoma site. The stoma is eventually brought out through a keyhole incision in the mesh and matured.[57]



It has been observed that mesh infections in patients who had undergone laparoscopic ventral hernia repair occurred in less than 1% of cases.[58] One of the big advantage of the laparoscopic approach for repairing ventral hernias is the reduction in infectious complications.[59,60]

The enhanced view totally extraperitoneal (eTEP) technique is a new technique for the repair of ventral and incisional hernias. It was initially devised for repair of inguinal hernia.

The **advantages** were rapid and effortless creation of large extraperitoneal space with more flexible port placement. It is used for large inguino scrotal, incarcerated or sliding inguinal hernia.

It is also useful for obese patients and those with a short distance between umbilicus and pubis or multiple previous pelvic surgeries.

Patients with loss of domain, ulcerated skin, active mesh infection and fistulae are absolute contraindication to eTEP technique. All other patients with ventral or incisional hernia can be suitable candidate for eTEP approach with or without TAR (Transverse Abdominal Release).

The eTEP approach is basically starting the dissection in one of the retrorectus spaces and then crossing over to the contralateral retrorectus space and then connecting the two spaces.

Port placement. Port placement and site of crossover depends on the defect location.

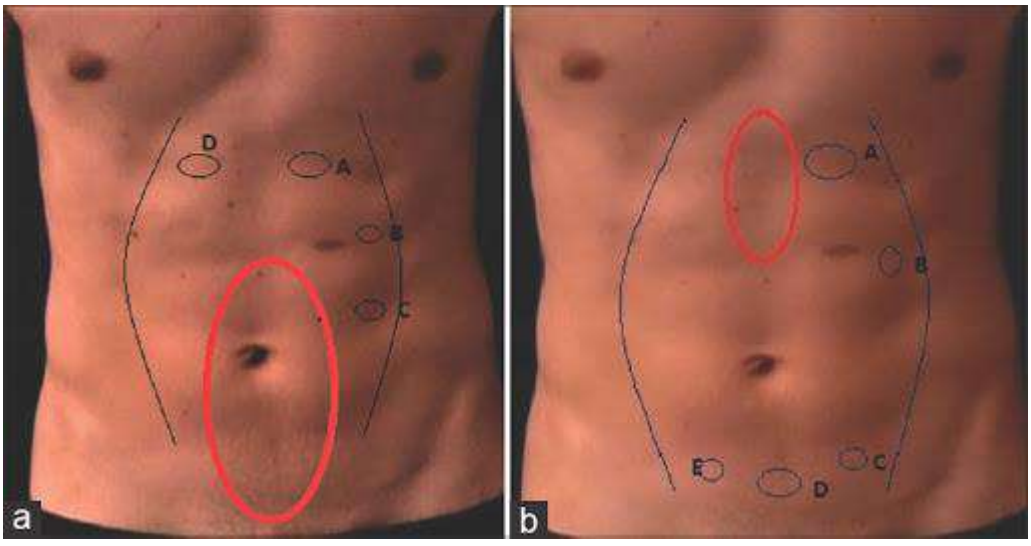
(a) Lower midline defects:

First port is placed in left subcostal area just medial to linea semilunaris. second and third ports are placed at and below umbilical level just medial to linea semilunaris on left side. Fourth port is placed through upper aspect of the right rectus abdominis muscle. Balloon dissection is used at port number one to develop left retro rectus space after dividing anterior rectus sheath.

Left retro rectus space is created in caudal direction till pubis.

Medial aspect of left posterior rectus sheath is incised above the level of umbilicus and pre peritoneal space is entered superficial to falciform ligament. Right posterior rectus sheath is identified and medial aspect of it is incised and released from cranial to caudal direction.

The retrorectal dissection is done in caudal direction resulting in bilateral release of posterior rectus sheath (PRS)



(b) Upper midline defects

1st port is just below umbilical level on right side just medial to linea semilunaris. 2nd and 3rd ports are placed on right and left suprapubic region medial to linear semilunaris.

The space of retzius is developed bilaterally.

PRS is identified and divided from caudal to cranial direction.

The hernia sac is dissected and divided sharply. If the defect size is more than 6 cm TAR is done.

The transversus abdominis is released 0.5 to 1 cm medial to the linea semilunaris to expose a broad plane that extends from the central tendon of the diaphragm superiorly to the Space of Retzius inferiorly and laterally to the retroperitoneum.

A space between transversus abdominis and facia transversalis is created.

This step is started in upper third of abdomen where medial fibres of the transversus abdominis are easiest to identify and separate.

This preserves the neurovascular bundle innervating the medial abdominal wall. The posterior rectus facia is advanced medially and closed.

The mesh is placed on a sublay and the linea alba is restored ventral to the mesh creating a functional abdominal wall, while pneumoperitoneum is dropped to 8 mmHg.

The normal polypropylene mesh of size 30 cm x30 cm is deployed widely covering the defect. Mesh can be fixed with trans fascial sutures, tackers or 10 ml fibrin glue. It can be left without fixation also.

BELYANSKY et al studied Seventy-nine patients (n = 34 Male, n = 45 Female) with mean age 54.9 years, mean BMI 31.1 kg/m^2 , and median ASA score 2.0.[9]

Thirty-four percent of patients had prior ventral or incisional hernia repairs.

The most frequent comorbidities in their patients were hypertension (46%) and diabetes (19%).

Primary operations performed were eTEP access Rives Stoppa Repair n = 38 (48%) and eTEP access TAR n = 41 (52%).[9]

A variety of mesh fixation techniques were utilized, with fibrin glue used in the majority of cases (75%) to secure the mesh to the posterior fascial layer.

Mean operative time, intraoperative blood loss, and LOS for the entire cohort were 218.9 min, 52.6 mL, and 1.8 days, respectively.

Intraoperative complications included one muscle rupture during initial balloon dissection requiring conversion to LVHR procedure and one conversion to open transversus abdominis release to facilitate excision of a suspicious bone fragment in a patient with a recurrent incisional hernia and prior history of bowel obstructions.

Two patients developed retro-muscular seromas.

They concluded that eTEP access VHR technique offers use of retro-rectus space and allows for complete exclusion of mesh from the peritoneal cavity, thus avoiding direct contact between mesh and visceral contents.[9]

Studies from other institutions report complication rates of 20–30% after open AWR surgery [61,62]; these findings have been confirmed at their center as well.[63] These invasive methods would translate to greater LOS and data from their institutions show open AWR patients spent a mean of 5 days in the hospital.[63]

Several other large series show hospital length of stay for complex open ventral and incisional hernia repair patients ranging from 5 to 10 days.[64,65] The mean LOS for their eTEP patients was 1.8 days; when broken down by Rives Stoppa technique and TAR, their mean LOS was 1.0 and 2.7 days, respectively, highlighting benefits for patients and the current cost-containment environment of health care for both of these procedures.

This short hospital stay was mainly related to a low level of pain.

Six months after eTEP access VHR, most patients in their series showed significant relief from pain and movement limitation. Colavita et al. had used CCS to report on QOL outcomes in patients who had undergone ventral hernia repairs. The mean defect area and percent of patients with prior ventral hernia repair in their study were 89.4 cm^2 and 21.7%, respectively. They reported 57% of their patients had significant pain prior to surgery, and at 4 weeks after LVHR, 56% of patients reported significant symptoms. After 6 months of follow-up, it decreased to 25%.[66] In their cohort of patients, they observed similar degree of symptomatic patients in the preoperative setting, with 58.5% of patients having significant pain before surgery. Following their cohort

at 1 months and at 6 months, 23.7 and 18.8% of patients, respectively, reported pain.

The relationship of penetrating fixation to chronic pain is well established.[67-71]

Weltz et al. described that transfascial fixation of mesh is 12 times more likely to result in chronic pain at 6 months as compared to non-penetrating fixation in retromuscular repair.[63]

This study supports that eTEP access VHR is a reproducible technique among experienced laparoscopic surgeons.

Another drawback of study was that only one center (AAMC) participated in QOL assessment which limited the generalizability of the result. To determine the true applicability, reproducibility, and benefits of eTEP access in AWR patients, randomized multicenter prospective studies are needed.

Baig et al operated upon a total of 21 cases of eTEP until December 2017 with mean age 54.67 years, 6 were males and the other 15 females. Mean BMI 28.57 kg/m^2. Three patients were diabetic, four were hypertensives and one had CAD, and one had a history of CVA. Out of 21, 3 patients had a primary hernia, and 18 had an incisional hernia. 5 had a recurrent hernia.

They performed 9 cases with eTEP RS approach and rest 12 cases underwent eTEP TAR. The mean operating time was 176.48 min and ranged from 138 to 310 min. the operating time went down with experience. Mean defect width was 6.65 cm and defect area was 45.33 cm^2. The mean mesh area was 535 cm^2, mesh size typically used was 30 cm × 30 cm mesh for eTEP TAR and 20 cm × 25 cm mesh for eTEP RS, depending on the patient's build and defect size. All the patients are ambulated on post-operative day (POD) 1 except one patient who had anterior dehiscence and underwent secondary suturing on POD 1. Most of the patients are discharged on POD 2 or 3 with a mean time from surgery to discharge being 2.67 days and range being 2–5 days.

eTEP technique for ventral hernias was developed by Dr. Belyansky et al. It is a new technique that involves developing the retro-rectus space bilaterally and connecting them, with minimal access method, to

duplicate the open RS repair. For larger defects, the same plane can be utilised to perform PCST (TAR), as described by Dr. Yuri Novitsky, to enable tension-free closure of hernia gap and achieving a greater mesh overlap. They have used the technique for hernias with a width of 4–12 cm. It is difficult for them to suture defects wider than this. They prefer to use IPOM-plus for smaller defects because of its ease and less operative time.

In the series, there was 1 recurrence in the short to medium term follow-up. This recurrence was due to misjudgement of mesh size required. It led to a mesh size that was actually smaller than needed. The complications namely linea alba dehiscence and recurrence-indicate the long learning curve which can be improved with further work and experience.

The steep learning curve and the longer operative time are the main drawbacks of the procedure. They concluded that eTEP is an great option for selected cases because of better outcome.

Shakya et al in their study noticed decreased wound complications, improved cosmesis, and faster recovery.[72] They commented that there are mesh- and tacker-related complications with IPOM, and the benefit of evolving laparoscopic ventral hernia repairs is avoiding the placement of a prosthetic mesh in an intraperitoneal position and thus avoiding the direct contact with intra-peritoneal organs.[73-78]

The retrorectus approach has the benefits of a previously unaccessed virgin plane of dissection to work in, and with techniques like TAR, the purpose of which is to decrease the tension in the defect so that its closure is made possible; it also provides a large area for placing a mesh beyond the linea semilunaris and strengthening of the fascias with minimal transfascial fixation.[75]

Mesh for hernia repair are now being accepted universally as a strengthening layer after inflammation and body reaction. However, there are planes where mesh can be placed in ventral and incisional hernias.[75-78]

The planes are onlay, inlay, sublay, underlay, and intraperitoneal onlay.[75-78]

This extraperitoneal placement is the approach avoiding the contact of the mesh with the intraperitoneal organs hence the potential complications such as adhesions, mesh erosion, and fistulations, with an added advantage of a relatively lower cost due to the use of cheaper meshes and also lower recurrence rates in large-volume studies.[75-78] Difficulties are present there with this new technique shown by the long time interval between the first open Rives-Stoppa repair and the first laparoscopic one, i.e., the e-TEP method.[74,79,80]

There are certain steps in this technique which require a meticulous technique and careful dissection:

(1) The first port insertion has to be inside the linea semilunaris; ultrasonological guidance and preoperative surface marking of the linea and margins of the defect are helpful here; use of the open technique with telescopic dissection reaching into the retrorectal space; balloon dissection and visiport insertion have been described to assist properly as well.[78]

(2) Proper dissection around the hernia defect is needed to create a working space as large as possible, because premature peritoneal puncture would lead to pneumoperitoneum and loss of the working space.[74]

(3) This requires crossover from the retrorectal space on the ipsilateral side into the opposite side space around the hernia defects and in both the supra- and infraumbilical regions.[76]

Complications leading to conversion to open or traditional laparoscopic techniques and postoperative complications such as recurrence, seroma formation were reported.[74,76,78]

In implementing the e-TEP approach, they have followed the guiding principles of Novitsky et al., Daes et al., and Belyansky et al.[73-75,79,80]

The e-TEP repair technique which they used was first described for laparoscopic inguinal hernia repair by Daes et al. and then extended to ventral hernia repairs by Belyansky et al.[74,81,82] Belyansky et al. went one step further to add TAR to their series of complex abdominal wall reconstruction, both laparoscopic and robotic [75,83] component separation in the form of TAR, is necessary for closure of large defects

and hernias situated at difficult sites such as suprapubic, subcostal, and lumbar hernias; this helps restore the anatomy, physiology, and functionality of the abdominal wall in complicated situations.[84-90]

RADU et al [78] in their study evaluating the pros and cons of the eTEP approach concluded that postoperative length of stay was the same for most patients: 81.7% (49 patients) spent only one post-op night in the hospital. The median postoperative stay was similar for all eTEP patients, regardless of surgery time or underlying hernia pathology. This short hospital stay was mainly related to a low level of pain.

Intraoperative incidents like: rupture of the semilunaris line at the start of the procedure, while creating the retro-rectus space caused by over-inflation of the balloon (one case), required a TAR to cover for the damaged area and a small bowel perforation during dissection which required suturing (one case).

The conversion (four cases) was due to respiratory difficulties (two cases), intensive fibrosis in the retro-rectus space (one case) and bowel adhesions to a previous mesh in another case.

In-stay complications are represented by: one case of suture disruption (mechanical failure) that needed an open procedure to re-approximate the linea alba and one case of umbilical hematoma in a patient that stayed 3 days under medical supervision in the hospital but without the need for an active intervention.[78]

One early readmission was due to a small bowel obstruction caused by a tear in the posterior layer that needed laparoscopic suture. They concluded that the complication was because of too much tension in the posterior layer. From that point on they have always focused on reducing posterior layer tension. The other case had hemorrhagic gastritis due to excessive NSAID use. Chronic pain (pain persisting for 3 months postoperatively which impairs daily activities) was recorded in two cases: one of them was a patient with a semilunaris line tear during balloon inflation and the other one a patient with a multisite hernia. At the 2-year follow up the patient with the semilunaris line tear showed a complete recovery, with no impairments or pain.[78]

There are no recorded recurrences in their cohort at the mean follow-up of 15 months (min 7 and max 26) in 56 out of 60 patients (4 patients were considered lost to follow-up)

Belyansky et al retrospectively reviewed laparoscopic retromuscular hernia repair cases by the eTEP access approach in seventy-nine patients with mean age 54.9 years, mean BMI of 31.1 kg/m2, and median ASA of 2.0 were included. Average mesh area of 634.4 cm2 was used for an average defect area of 132.1 cm2. Mean operative time, blood loss, and length of hospital stay were 218.9 min, 52.6 mL, and 1.8 days, respectively. There was one conversion to intraperitoneal mesh placement and one conversion to open retromuscular mesh placement. Postoperative complications consisted of seroma (n = 2) and trocar site dehiscence (n = 1). Comparison of mean pre- and postoperative CCS scores found significant improvements in pain (68%, p\0.007).[74]

Belyansky et al performed laparoscopic abdominal wall reconstruction for complex hernias in August and September of 2015 on three patients. Operative approach consisted of laparoscopic transversus abdominis components separation, defect closure, and wide mesh implantation in the retromuscular space. Two males and one female with mean age and body mass index of 70 and 30.1, respectively, underwent a mean operation room time of 329 minutes. Estimated blood loss and length of stay were 91.7 cc and 4.7 days, respectively. No subcutaneous flaps were raised avoiding the need for subcutaneous drains. There were no perioperative complications. All of the subfascial drains were removed prior to patient discharge. On initial follow-up visit at 3 weeks, there was no evidence of wound complications, bulging, or hernia recurrences. They concluded that laparoscopic abdominal wall reconstruction with transversus abdominis release is unique and feasible approach to complex abdominal wall defects with the added advantages of reducing pain, facilitating recovery, and decreasing the length of hospital stay.[75]

Novitsky et al From December 2006 to December 2014, consecutive patients undergoing open AWR utilizing TAR were identified in their prospectively maintained database and reviewed retrospectively. Main outcome measures included demographics, perioperative details, wound complications, and recurrences. During the study period, 428 TAR procedures were analyzed. Mean age was 58, mean body mass index 34.4 kg/m^2 (range 20–65). Major comorbidities included diabetes (21%), chronic obstructive pulmonary disease (12%), and immunosuppression (3%). Mean hernia defect area was 606 cm^2 (range 180–1280) and average mesh size was 1220 cm^2 (range 600–4500). The majority of cases (66%) were clean, 26% were clean contaminated, and 8% were contaminated.[64] Eighty (18.7%) surgical-site events occurred, of which 39 (9.1%) were surgical-site infections. Three patients required mesh debridement; however, no instances of mesh explantation occurred. Of the 347 (81%) patients with at least 1-year follow-up (mean 31.5 mo), there were 13 (3.7%) recurrences.[64]

Colavita et al did a study from September 2007 to July 2011 for LVHR and OVHR. Carolinas Comfort Scale (CCS) was utilized to quantify QOL (pain, movement limitation, and mesh sensation) preoperatively and at 1, 6, and 12 months postoperatively and concluded from a total of 710 repairs that included 402 OVHR and 308 LVHR. Demographics were mean age 57.1 ± 13.3 years, 49.6% male, 21.7% recurrent hernias, mean body mass index of 30.3 ± 6.6, and mean defect size of 89.4 ± 130.8. Preoperatively, 56.9% had pain, and 53.2% experienced movement limitation. At 1-month follow-up, 587 (82.7%) patients were provided CCS scores; more LVHR patients experienced pain ($P < 0.001$) and movement limitations ($P < 0.001$). At 6 and 12 months, there were no differences in QOL with 466 (65.6%) and 478 (67.3%) patients responding, respectively. After controlling for confounding variables, LVHR was independently associated with more frequent discomfort [odds ratio (OR) = 1.9, confidence interval (CI): 1.2–3.1], movement limitation (OR = 1.6, CI: 1.0–2.7), and overall symptoms (OR = 1.6, CI: 1.0–2.6) at 1 month. LVHR resulted in a shorter length of stay (LOS) ($P < 0.001$) and fewer infections ($P = 0.004$), but overall

complication rates were equal. Recurrence rates were also equal (P = 0.66).[66]

Raftopoulos I et al. did a Comparison of Open and Laparoscopic Prosthetic Repair of Large Ventral Hernia with objective to compare open with laparoscopic ventral hernia repairs. Fifty laparoscopic and 22 open ventral hernia repairs were included in the study. All patients underwent a tension-free repair with retromuscular placement of the prosthesis. No significant difference between the 2 groups was noted regarding patient demographics and hernia characteristics except that the population in the open group was relatively older (59.4 vs 47.82, P<0.003). They found no significant difference in the operative time between the 2 groups (laparoscopic 132.7 min vs open 152.7 min). Laparoscopic repair was associated with a significant reduction in the postoperative narcotic requirements (27 vs 58.95 mg IV morphine, P<0.002) and the lengths of nothing by mouth (NPO) status (10 vs 55.3 hrs, P<0.001), and hospital stay (1.88 vs 5.38 days, P<0.001). The incidence of major complications (1 vs 4, P<0.028), the hernia recurrence (1 vs 4, P<0.028), and the time required for return to work (25.95 vs 47.8, P<0.036) were significantly reduced in the laparoscopic group.[91]

MATERIAL AND METHODS

Material and method

It is an observational study of 52 patients admitted to DMCH in the time period between 1 November 2018 to 31 March 2020.

All patients above the age of 18 y presenting to DMCH Ludhiana for repair of ventral and incisional hernia by the eTEP approach were included in the study.

Inclusion criteria

Age > 18 y

ASA grade less than 4

Patient willing for laparoscopic repair of ventral and incisional hernia by the eTEP approach

Exclusion criteria

Age < 18 y

Incarcerated, strangulated hernia

ASA grade 4 or more

Hernia defect size more than 15 cm (transverse diameter)

Active infection, ulcerated skin

Loss of domain, obstructed or strangulated hernia

Prior mesh placement in the retrorectus space

Contraindications for anesthesia and surgery like patient unfit to undergo surgery by laparoscopic approach

Coagulopathy

COPD

PREOPERATIVE WORK UP

Routine **investigations** including hemogram, renal function tests, coagulation profile, chest x-ray and electrocardiogram are done in all patients. Patients are kept nil per orally to solids 8 hours prior to surgery and clear liquids 2 hours prior.

SURGICAL STEPS

The key stages of the eRives and eTEP-TAR procedures are:

1. Development of the retro-rectus space and port placement.
2. Cross-over of the midline.

3. Connection of both retro-rectus spaces, left and right.

4. TAR (when needed [8]).

5. Closure of the defect and restoration of linea alba.

6. Mesh placement.

7. Exsufflation.

1. Development of the retro-rectus space and port placement.

Conversely to the traditional laparoscopic approach, the ports have to be placed medially to the semilunaris lines for ergonomic reasons.

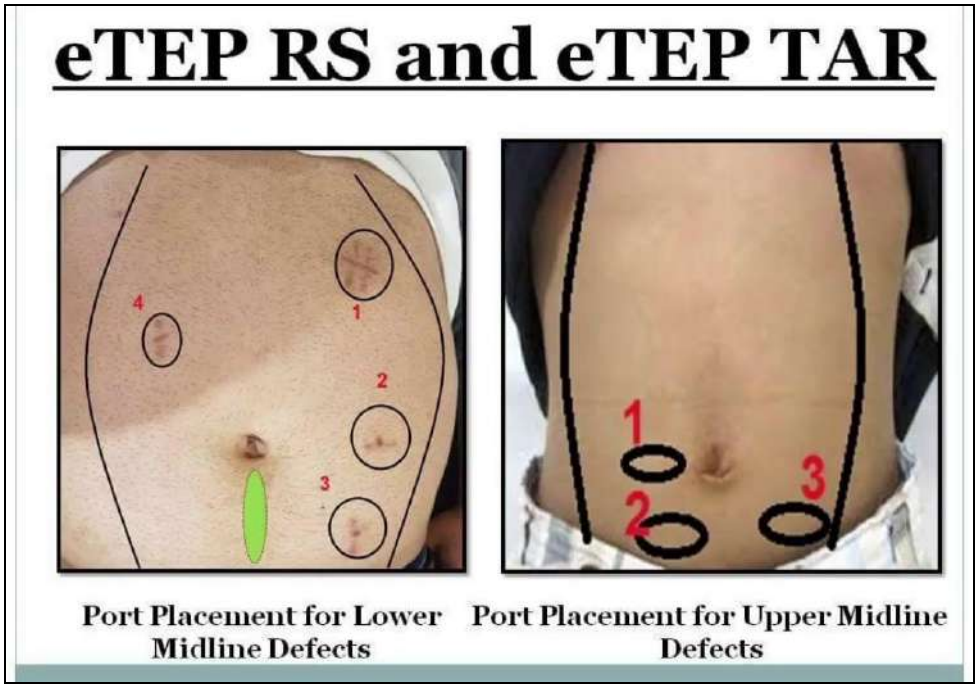
The linea semilunaris is the most important landmark for port placement.

As a rule, the ports have to be placed opposite to the side of the abdomen related to the hernia location:

• Hernia located in the lower part of the abdomen: the ports will be placed above the umbilicus.

• Hernia located in the upper part of the abdomen: the ports will be placed below the umbilicus

• Hernia located laterally (hypochondrium, flank, lateral lower quadrant or lumbar): consider ports placement laterally, on the opposite side of the abdomen



eTEP RS

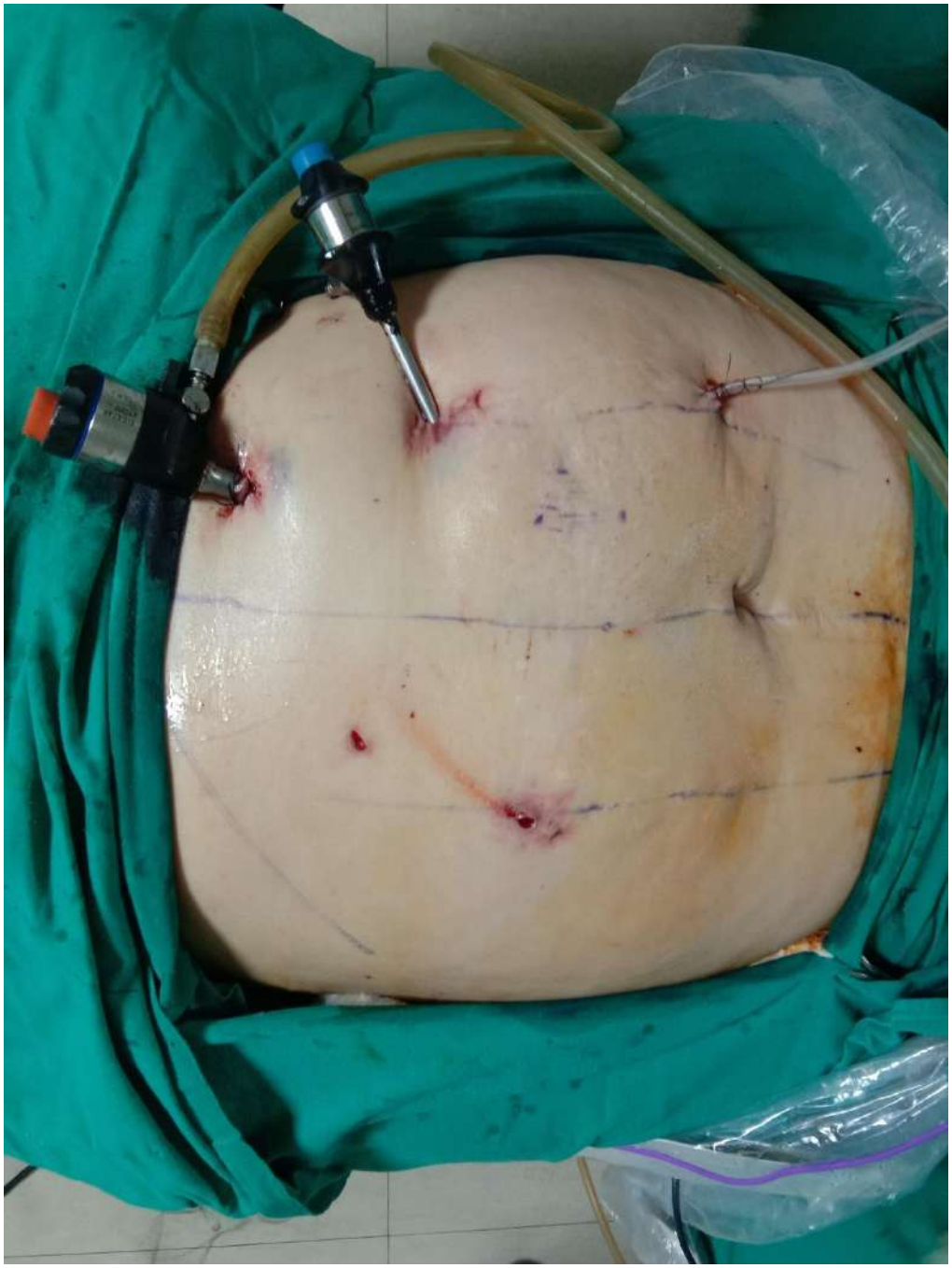
The extended view totally extraperitoneal (eTEP) technique is a novel technique for the repair of ventral and incisional hernias. The eTEP technique has been initially used for inguinal hernia repair.

The **advantages** were rapid and effortless creation of large extraperitoneal space with more flexible port placement. It is used for large inguinoscrotal, incarcerated or sliding inguinal hernia.

It is also useful for obese patients and those with a short distance between umbilicus and pubis or multiple previous pelvic surgeries.

Patients with loss of domain, ulcerated skin, active mesh infection and fistulae are absolute contraindication to eTEP technique. All other patients with ventral or incisional hernia can be suitable candidate for eTEP approach with or without TAR (Transverse Abdominal Release) .

The eTEP approach is basically starting the dissection in one of the retrorectus spaces and then crossing over to the contralateral retrorectus space and then connecting the two spaces



Skin markings are done preoperatively, defect site is marked,

Port placement

Port placement and site of crossover depends on the defect location.

In case of Lower midline defects:

1st port is placed in left subcostal area just medial to linea semilunaris

2nd and 3rd ports are placed at and below umbilical level just medial to linea semilunaris on left side.

4th port is placed through upper aspect of right rectus abdominis muscle if required

Balloon dissection/ blunt dissection with index finger is used at incision site for placing first port to develop left retrorectus space after dividing anterior rectus sheath.

Left retrorectus space is created in caudal direction upto pubis.

Medial aspect of left posterior rectus sheath is incised above the level of umbilicus and preperitoneal space is entered superficial to falciform ligament.

Right posterior rectus sheath is identified and medial aspect of it is incised and released from cranial to caudal direction.

The retrorectal dissection is done in caudal direction resulting in bilateral release of posterior rectus sheath (PRS)

Upper midline defects

1st port is just below umbilical level on right side just medial to linea semilunaris

2nd and 3rd ports are placed on right and left suprapubic region medial to linear semilunaris.

The space of retzius is developed bilaterally.

PRS is identified and divided from caudal to cranial direction.

The hernia sac is dissected and divided by sharp dissection using scissors or energy device.

Mesh is placed according to the defect size.

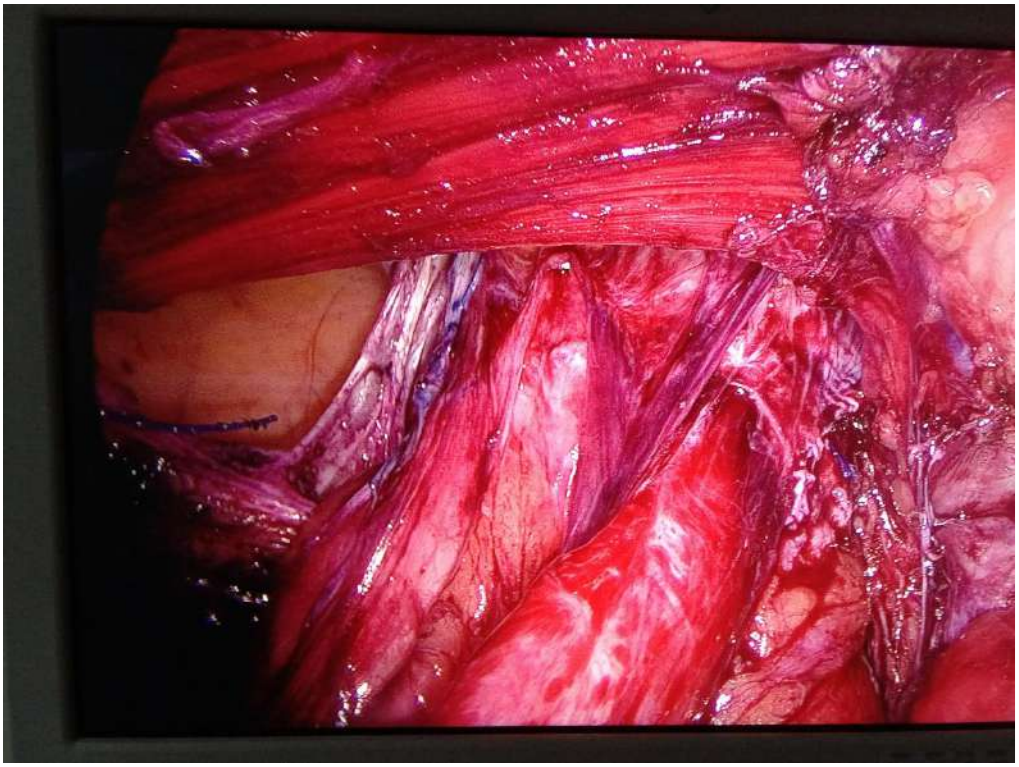
If the defect size is more than 6 cm TAR is done.

The transversus abdominis is released 0.5 to 1cm medial to the linea semilunaris to expose a broad plane that extends from the central tendon of the diaphragm superiorly to the Space of Retzius inferiorly and laterally to the retroperitoneum.

A space between transversus abdominis and facia transversalis is created.

This step is started in upper 3rd of abdomen where medial fibres of the transversus abdominis are easiest to identify and separate.

This preserves the neurovascular bundle innervating the medial abdominal wall.



The posterior rectus facia is advanced medially and closed.

The mesh is placed on a sublay and the linea alba is restored ventral to the mesh creating a functional abdominal wall, while pneumoperitoneum is dropped to 8 mm of mercury.

The entire area of dissection in the retrorectus space is measured and covered with mesh.

Mesh can be fixed with trans fascial sutures, tackers or 10 ml fibrin glue. It can be left without fixation also. We did not used any fixation technique in our patients.

Drains are kept to prevent seroma formation, slow exsufflation under direct vision to ensure that the mesh remains in position is done and instruments are removed under direct vision. Ports are closed using stapler or non absorbable synthetic suture (Ethilon 2 0'). Antiseptic dressing using primapore to cover the stapples and pressure bandage using dynaplast is done. Abdominal binder is worn by the patient post-operatively. Dressing is changed every 4th day or earlier in case of any soakage or discharge. Drains are removed postoperatively when output becomes less than 50 ml. All of the patients are encouraged to

ambulate post operatively as early as possible and discharged by third post operative day, range being 2-8 days.

Post operatively patients are followed up at regular intervals for any complication like surgical site infection, seroma formation, port site herniation, recurrence, chronic pain, etc. Pain assessement is done using the VAS score ranging from 0-10 with 0 being no pain, 1-3 being mild pain, 4-6 being moderate pain, 7-9 being severe pain and 10 being the worst imaginable pain. The preoperative VAS pain score is compared to the post-operative VAS pain score at 3 months post operative.

OBSERVATIONS AND RESULTS

PATIENT DEMOGRAPHICS

1. AGE

46 (88.5%) out of the 52 patients in our study were over the age of 40 years whereas 6 patients (11.5%) were below 40 years of age.

Table 1 AGE DISTRIBUTION

Age group	No. of cases	Percentage
< 40	6	11.5%
41-60	28	53.8%
> 60	18	34.6%
Total	52	100.0%

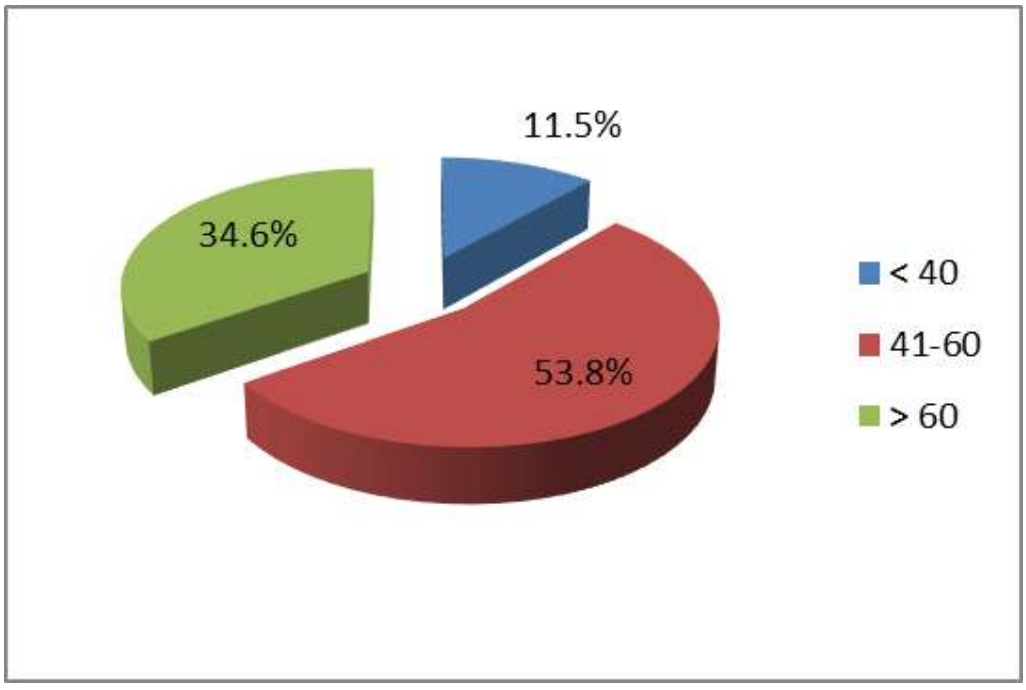


Figure 1 AGE DISTRIBUTION

Most of the patients operated by the TAR approach were above the age of 60 years whereas those operated by the RS approach were between the age group of 40-60 years.

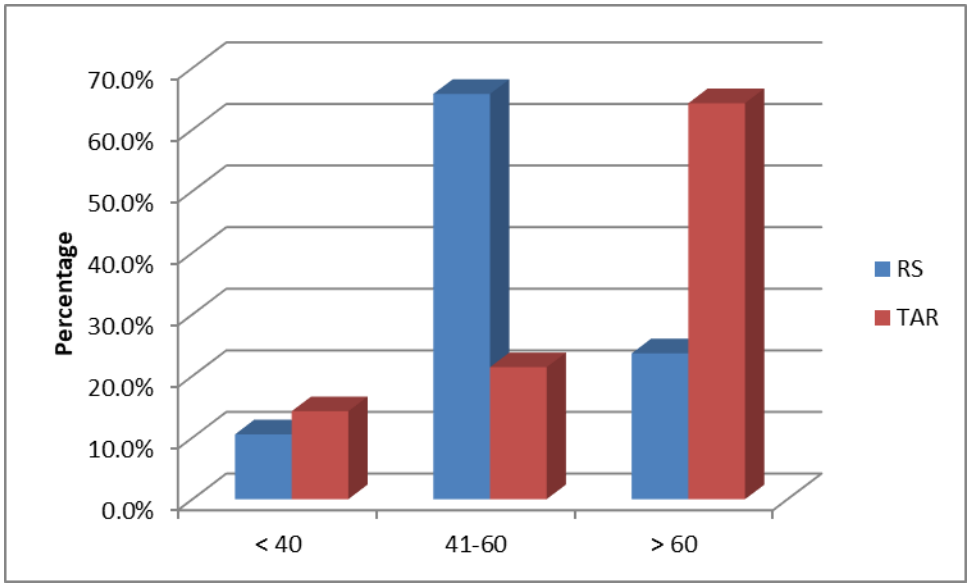


Figure 2 AGE DISTRIBUTION

2. SEX

33 patients (63.5%) were males and rest 19 (36.5%) were females

Table 2 SEX DISTRIBUTION

SEX	No. of cases	Percentage
F	19	36.5%
M	33	63.5%
Total	52	100.0%

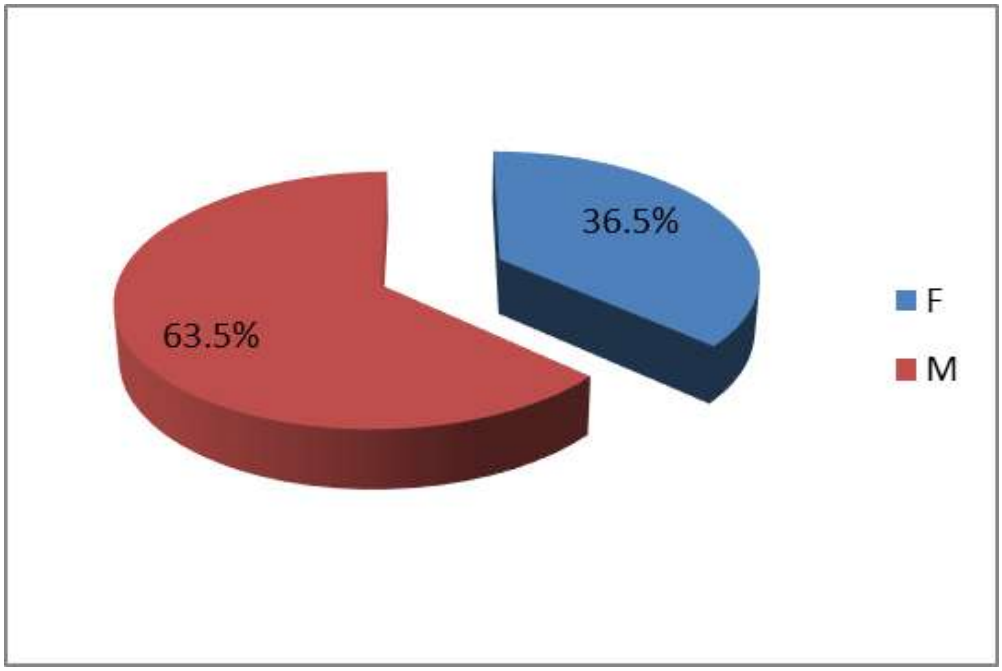


Figure 3 SEX DISTRIBUTION

3. BMI

Mean BMI of our patients was 26.07 kg/m^2. It was 26 kg/m^2 in patients operated by the RS approach and 26.26 kg/m^2 in those operated by the TAR approach.

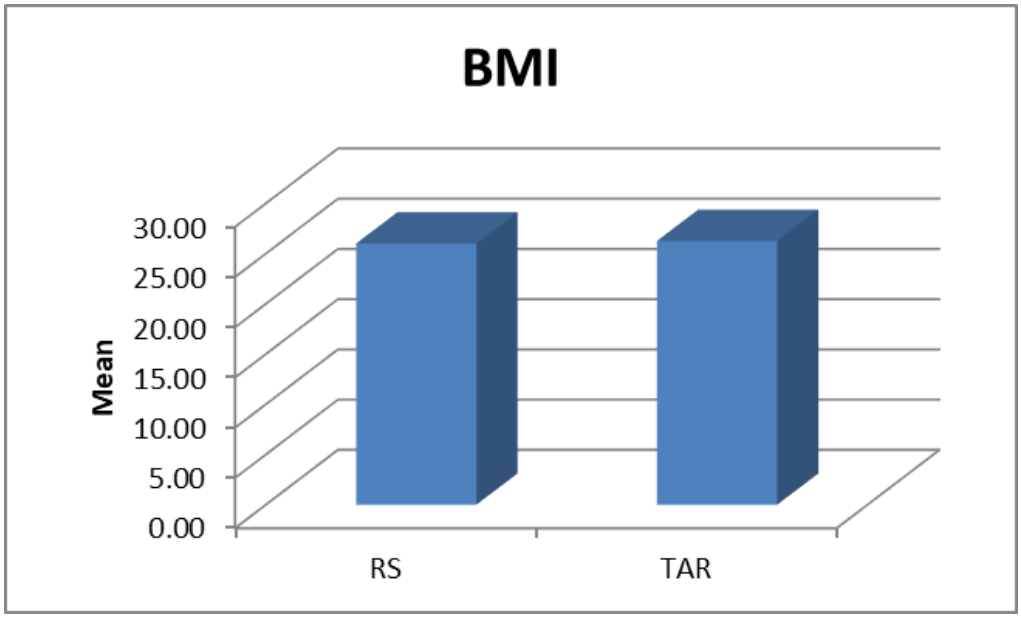


Figure 4 BMI DISTRIBUTION

4. ASA GRADE

25 (48.1%) of the 52 patients belonged to ASA grade 2. 20 patients (38.5%) belonged to ASA grade 1 and rest 7(13.5%) were ASA grade 3.

Table 3 ASA GRADING DISTRIBUTION

ASA	No. of cases	Percentage
1	20	38.5%
2	25	48.1%
3	7	13.5%
Total	52	100.0%

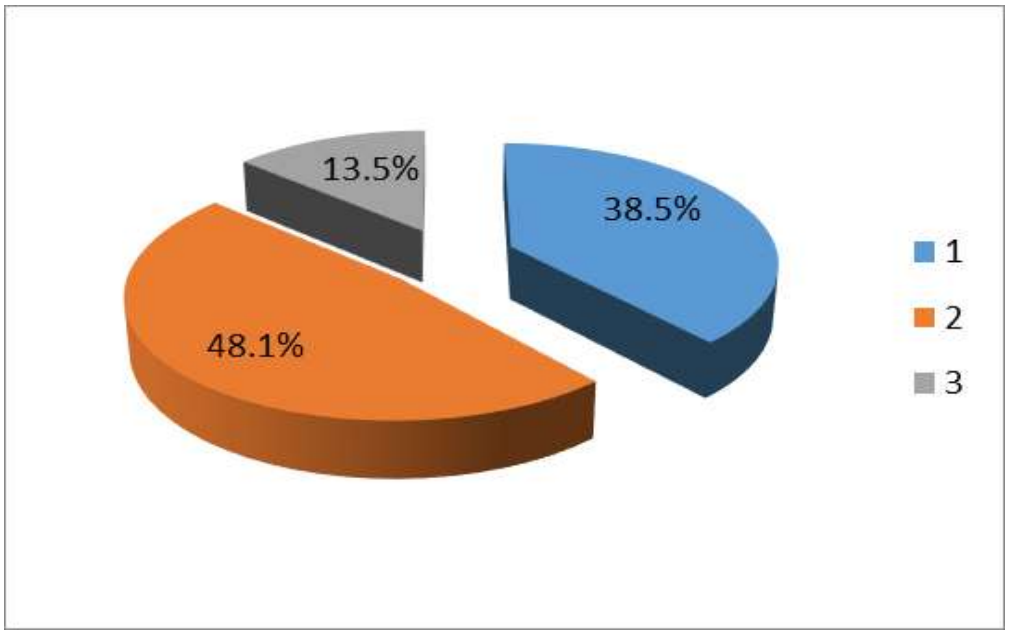


Figure 5 PIE CHART OF ASA GRADING DISTRIBUTION

5. COMORBIDITIES

7 Number of patient were diabetic, 8 were hypertensive, one patient had history of CLD, one patient had history of seizure disorder.

Smoking history was present in 7 cases.

HERNIA CHARACTERISTICS

6. TYPE OF HERNIA

25 out of the 52 cases had primary incisional hernia and the remaining 27 patients had primary ventral hernia.

Table 4 HERNIA TYPE

Ventral/Incisional	No. of cases	Percentage
I	25	48.1%
V	27	51.9%
Total	52	100.0%

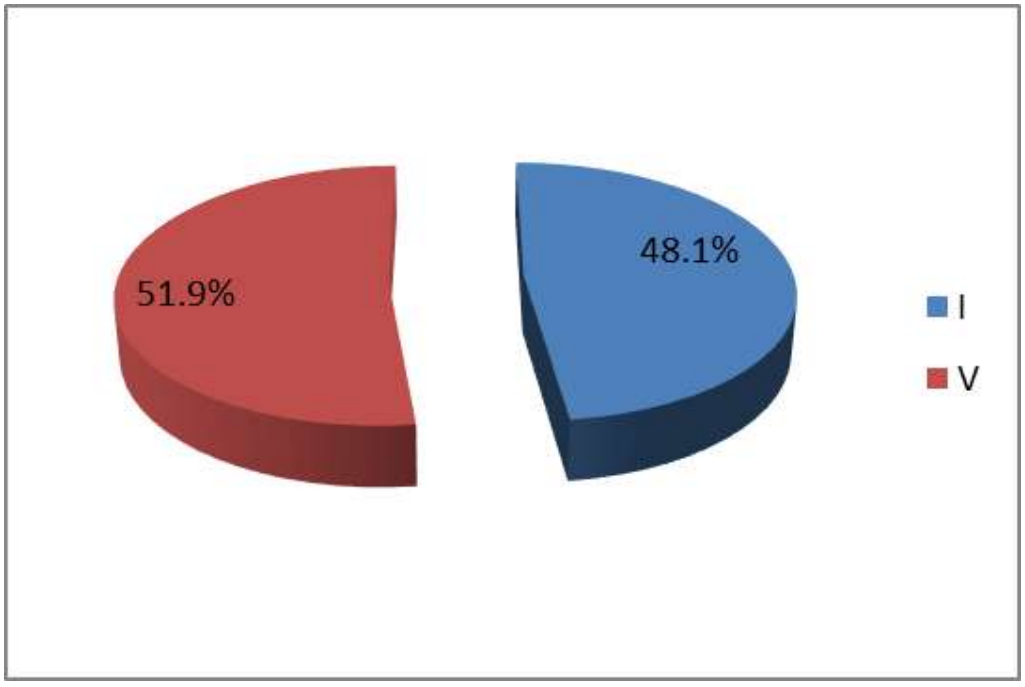


Figure 6 HERNIA TYPE

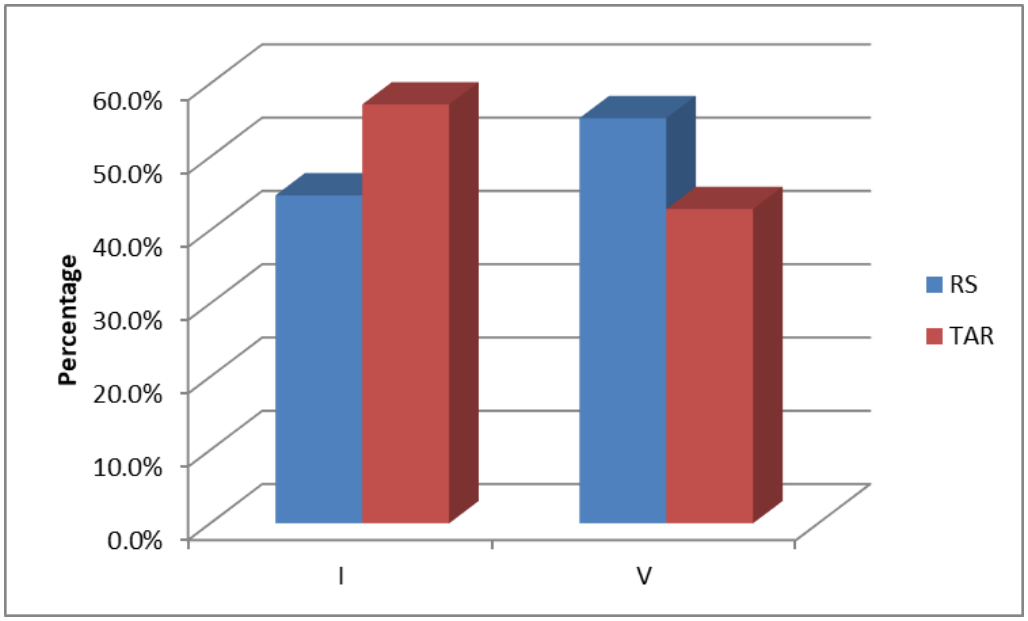


Figure 7 TYPE OF HERNIA AND APPROACH USED

Figure 8 PRIMARY VENTRAL HERNIA

7.REDUCIBILITY

46 out of the 52 cases had reducible hernia whereas the other 6 had irreducible hernia.

Table 5 SHOWING PERCENTAGE OF REDUCIBLE AND IRREDUCIBLE HERNIA

Reducible/Irreducible	No. of cases	Percentage
IR	6	11.5%
R	46	88.5%
Total	52	100.0%

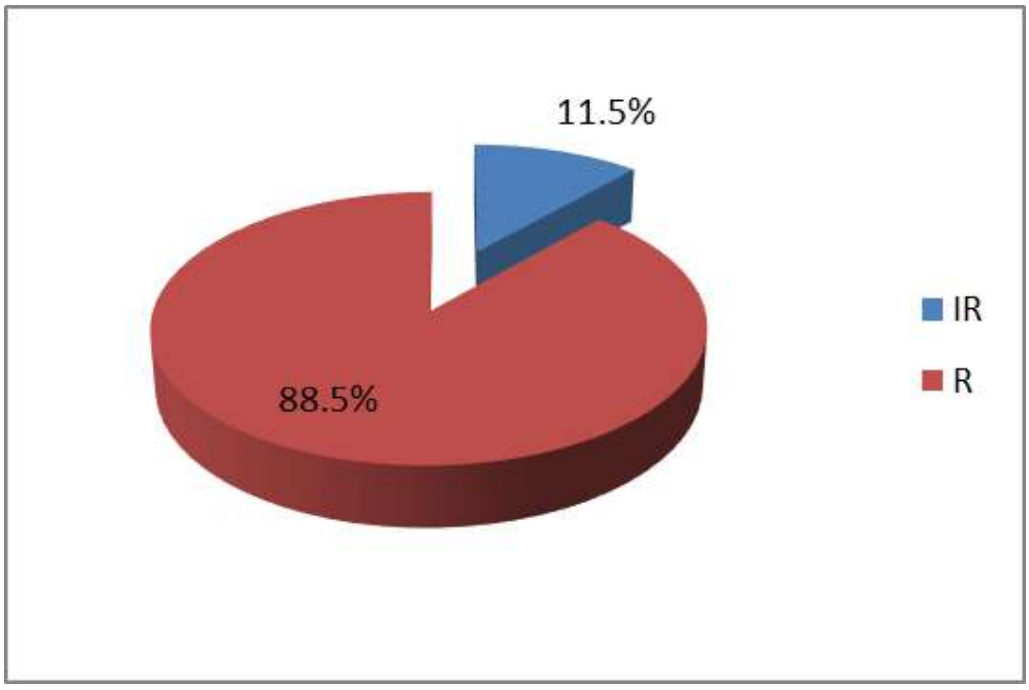


Figure 9 PIE CHART SHOWING PERCENTAGE OF REDUCIBLE AND IRREDUCIBLE HERNIA

8. OPERATIVE APPROACH

38 cases were operated by the RS approach whereas rest 14 were operated by the TAR approach.

Table 6 APPROACH USED FOR HERNIA REPAIR

approach	No. of cases	Percentage
RS	38	73.1%
TAR	14	26.9%
Total	52	100.0%

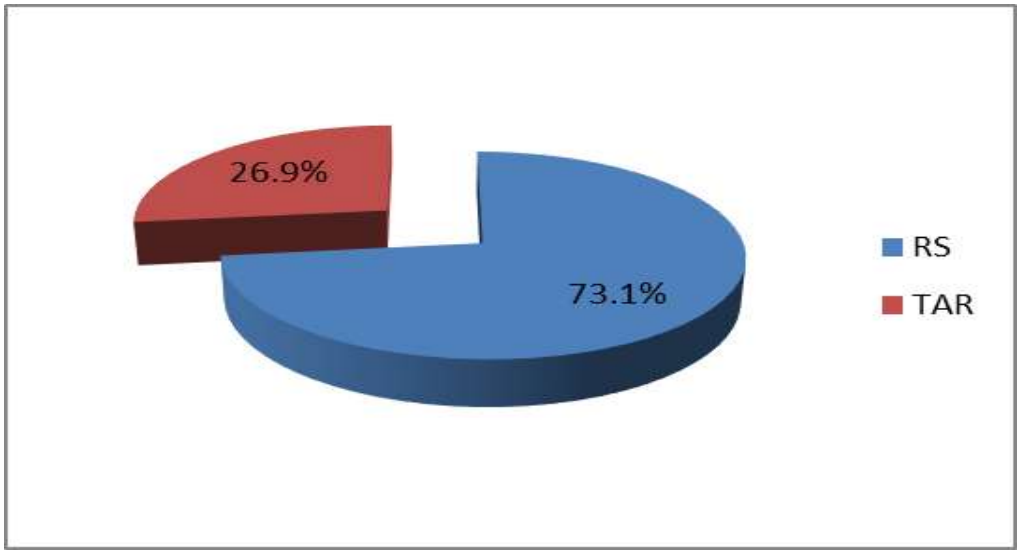


Figure 10 PIE CHART SHOWING THE APPROACH USED IN PERCENTAGE CASES

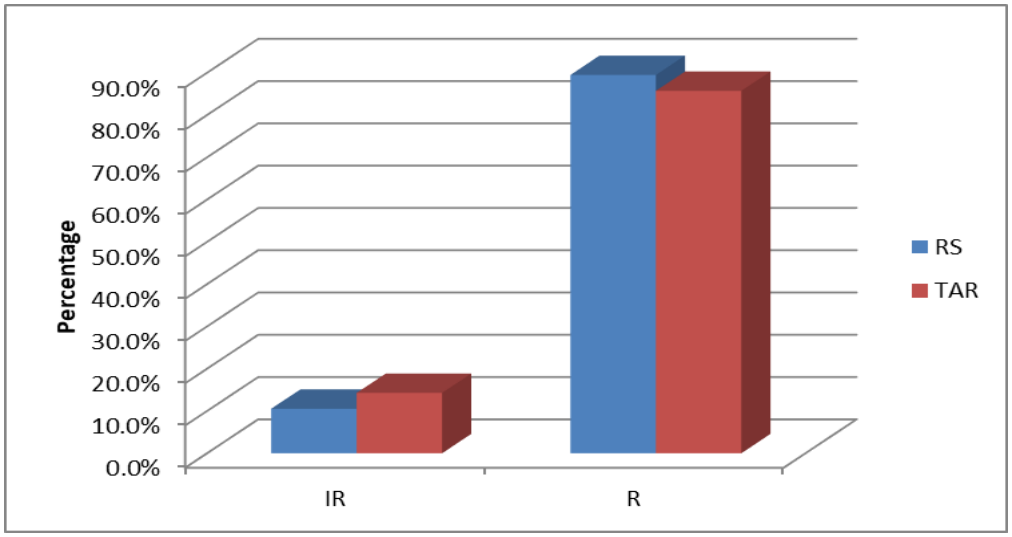


Figure 11 SHOWING PERCENTAGE OF REDUCIBLE AND IRREDUCIBLE HERNIA IN THE VARIOUS APPROACHES

9. MEAN OPERATIVE TIME

Mean operative time in case of eTEP RS was 168.5 minutes and in case of TAR was 231.79 minutes.

We also observed that the operating time went down with increasing experience.

Table 7 MEAN OPERATING TIME BY EACH APPROACH

	RS	TAR
Operating Time (min)	168.50	231.79

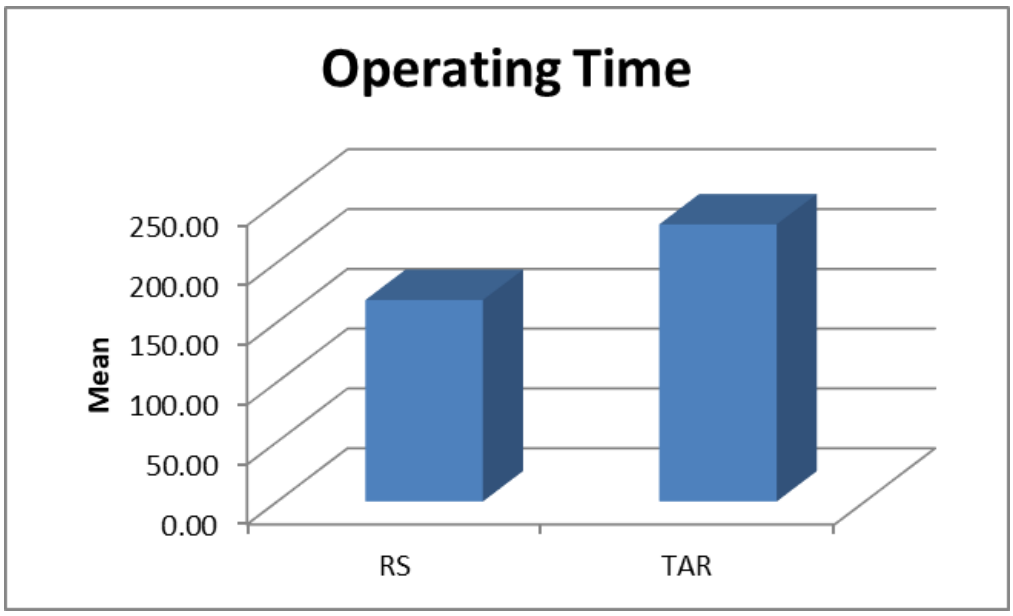


Figure 12 BAR CHART SHOWING THE MEAN OPERATING TIME (in minutes)

10. DEFECT SIZE AND AREA

Mean defect size in case of eTEP RS was 4.63 cm whereas in case of eTEP TAR it was 8.43 cm. Mean defect area was 28.46 cm^2 in case of patients operated by the RS approach and it was 44.29 cm^2 in case of patients operated by the TAR approach.

eTEP RS was done for defect ranging from 3.5 cm to 6 cm whereas for defects ranging from 6-10 cm eTEP TAR was the preferred approach.

Table 8 MEAN DEFECT WIDTH AND AREA IN EACH APPROACH

	RS	TAR
Defect Width (cm)	4.63	8.43
Defect Area (cm^2)	28.46	44.29

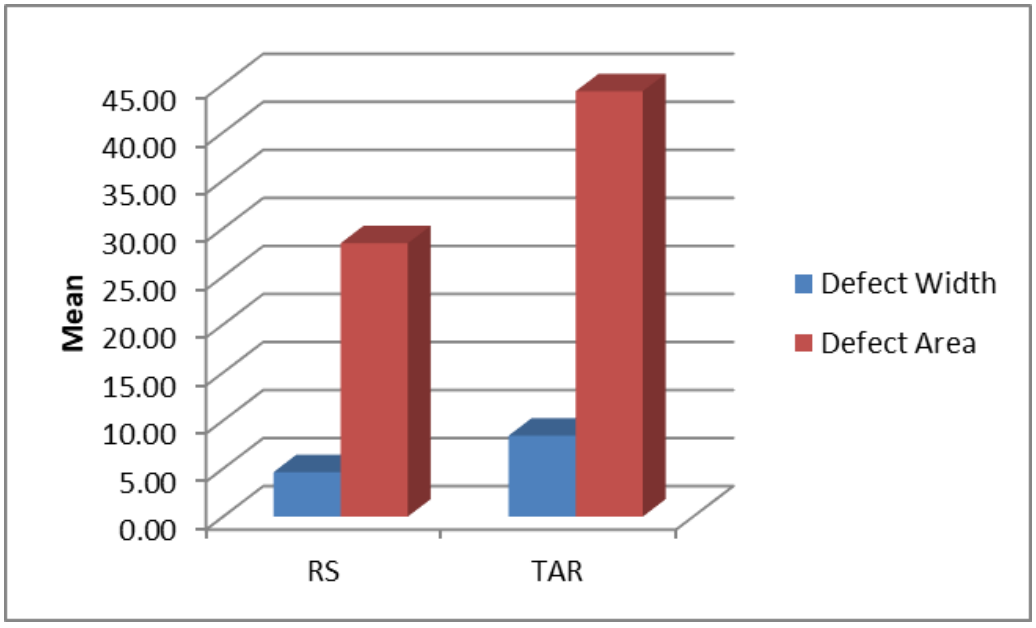


Figure 13 BAR CHART SHOWING THE MEAN DEFECT WIDTH AND AREA IN EACH APPROACH

Post op findings

11. LENGTH OF HOSPITAL STAY

Post op mean length of stay was 3.9 days, ranging from 2-8 days, it was average 5.1 days in case of eTEP TAR and 3.46 days in case of eTEP RS.

Table 9 MEAN LENGTH OF STAY IN EACH APPROACH

	RS (n=38)		TAR (n=14)	
	Mean	SD	Mean	SD
LOS (days)	3.46	0.86	5.10	1.73

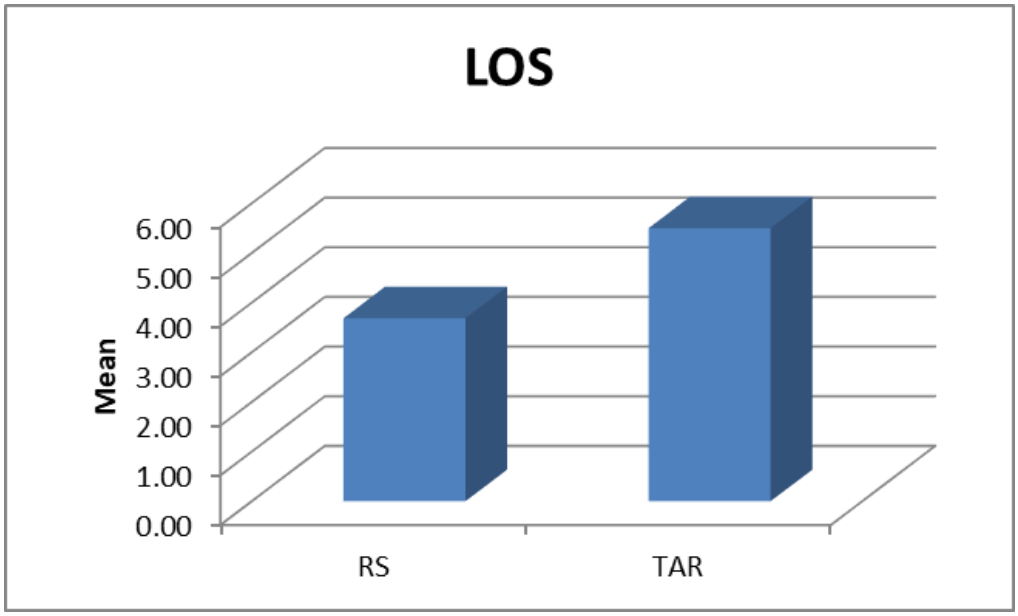


Figure 14 BAR CHART SHOWING MEAN LENGTH OF STAY (in days) IN EACH APPROACH

34 (65.4%) of the 52 cases operated got discharged within 4 days of admission.

Table 10 LENGTH OF STAY (IN DAYS)

LOS	No. of cases	Percentage
2	1	1.9%
3	21	40.4%
4	12	23.1%
5	11	21.2%
6	2	3.8%
7	3	5.8%
8	2	3.8%
Total	52	100.0%

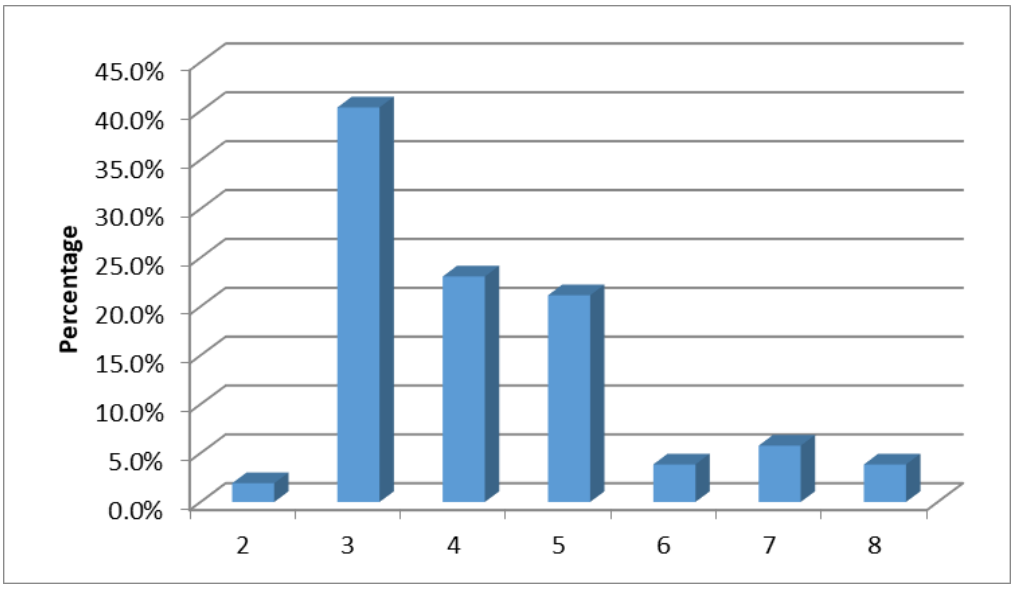


Figure 15 LENGTH OF STAY (IN DAYS)

12. COMPLICATIONS

Patients were followed for a minimum time period of 3 months post operatively

Seroma formation was seen in 2 number of patients and was managed conservatively.

Table 11 COMPLICATIONS POST OPERATIVELY

COMPLICATION		APPROACH				Total
		RS	RS	TAR	TAR	
SEROMA	NO	38	100.0%	12	85.7%	50
	YES	0	0.0%	2	14.3%	2
SURGICAL SITE INFECTION	NO	38	100.0%	14	100.0%	52
RECURRENCE	NO	38	100.0%	14	100.0%	52

Seroma formation was seen only in cases operated by the eTEP - TAR approach.

Inadvertent enterotomy occurred in one case intraoperatively for which the case was converted to open and primary repair of the bowel injury was performed.

There were no re-admissions in the first thirty days post operatively.

Hematoma, deep abscess, surgical site infection, port site herniation and wound dehiscence were not seen in any case.

Non wound related, systemic complications like UTI, stroke, pneumonia, CHF, etc were not seen in any patient. No patient required ICU stay in our study.

13. POST OP PAIN

Pain was assessed using the visual analog scale score which ranged from 0-10, with 0 being no pain, 1-3 being mild pain, 4-6 moderate pain and 7-9 being classified as severe agonising pain and score of 10 being the worst pain.

We observed less pain in the immediate post operative period, this may be due to placement of mesh in the retromuscular space which has minimised aggressive fixation of mesh with tackers.

Table 12 PRE OPERATIVE VAS SCORE

	VAS SCORE	Approach				Total
		RS	RS	TAR	TAR	
Pain	0	17	44.7%	8	57.1%	25
	1	5	13.2%	0	0.0%	5
	2	14	36.8%	1	7.1%	15
	3	2	5.3%	4	28.6%	6
	5	0	0.0%	1	7.1%	1
Total		38	100.0%	14	100.0%	52

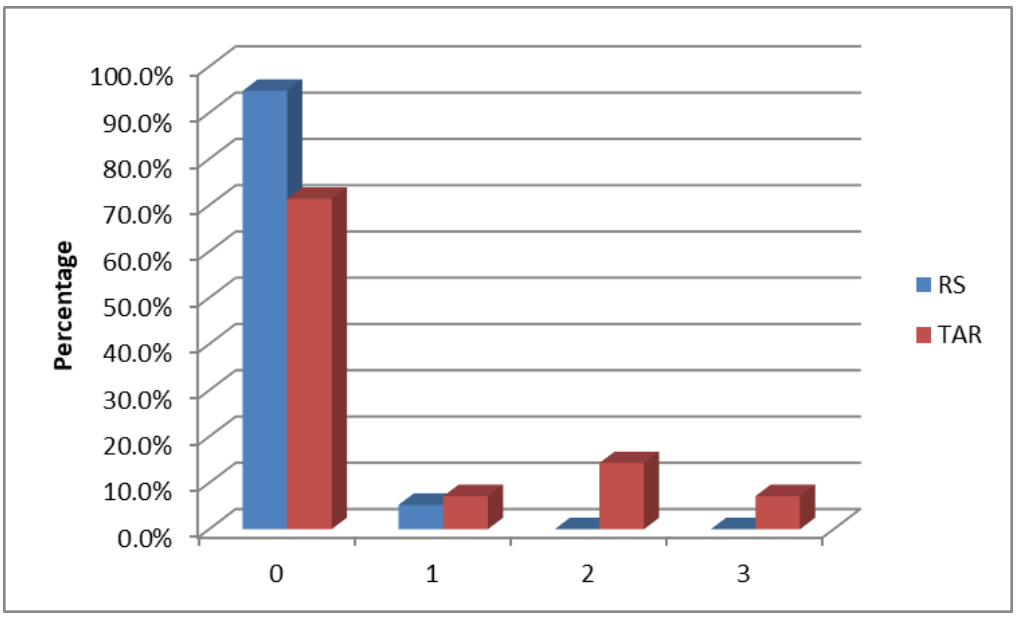


Figure 16 VAS SCORE BY EACH APPROACH

Chronic pain was seen in 6 patients and it was bearable (VAS score less than 3) and relieved with mild analgesics. No patient complained of significant pain at 3 months post operatively. 2 out of 36 patient operated by the RS approach complained of pain after 3 months and it was mild in intensity whereas 4 out of 14 patients operated by the TAR approach complained of mild pain at 3 months post op.

Table 13 VAS SCORE FOR CHRONIC PAIN BY APPROACH

		Approach				Total
		RS	RS	TAR	TAR	
CHRONIC pain	0	36	94.7%	10	71.4%	46
	1	2	5.3%	1	7.1%	3
	2	0	0.0%	2	14.3%	2
	3	0	0.0%	1	7.1%	1
Total		38	100.0%	14	100.0%	52

Table 14 VAS SCORE FOR CHRONIC PAIN

CHRONIC pain VAS score	No. of cases	Percentage
0	46	88.5%
1	3	5.8%
2	2	3.8%
3	1	1.9%
Total	52	100.0%

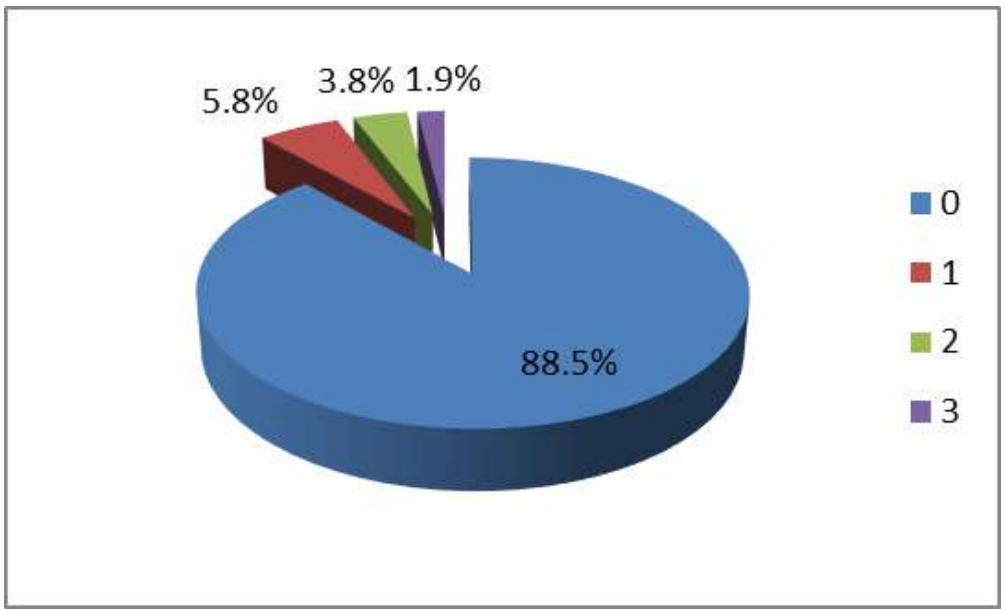


Figure 17 VAS SCORE FOR PAIN

Chronic pain was seen more in case of eTEP-TAR patients and mean VAS score was higher as compared to those operated by the eTEP RS approach.

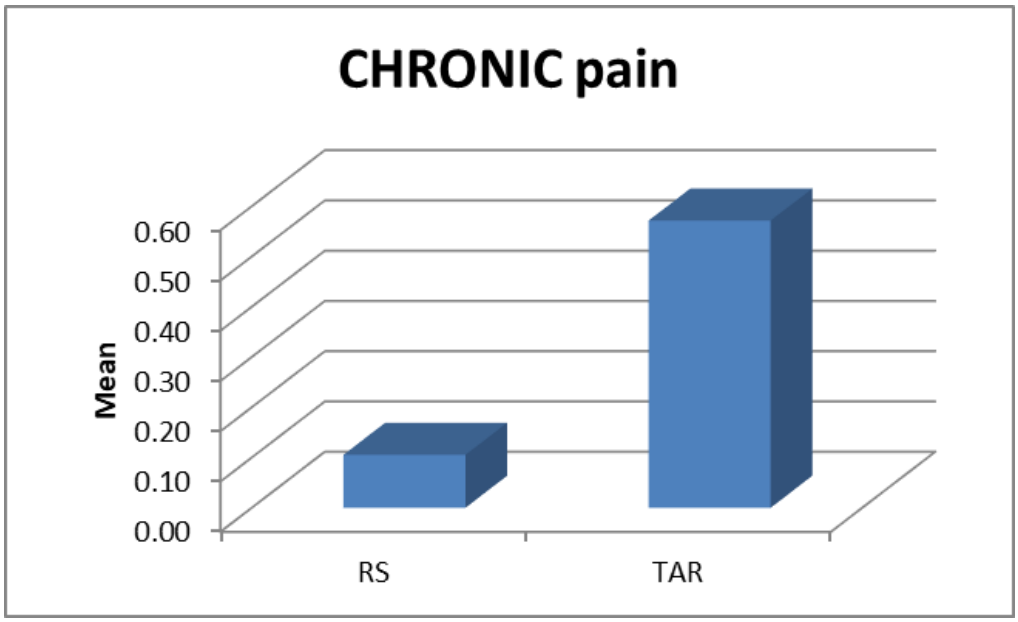


Figure 18 VAS SCORE FOR PAIN BY APPROACH

There was significant reduction in pain in post-operative period.

(p value=0.001)

Table 15 COMPARISON OF PRE-OP AND POST-OP PAIN

Pain	Mean	Std. Deviation	t	p-value
Before	1.12	1.25	-6.612	0.001
After	0.19	0.60		

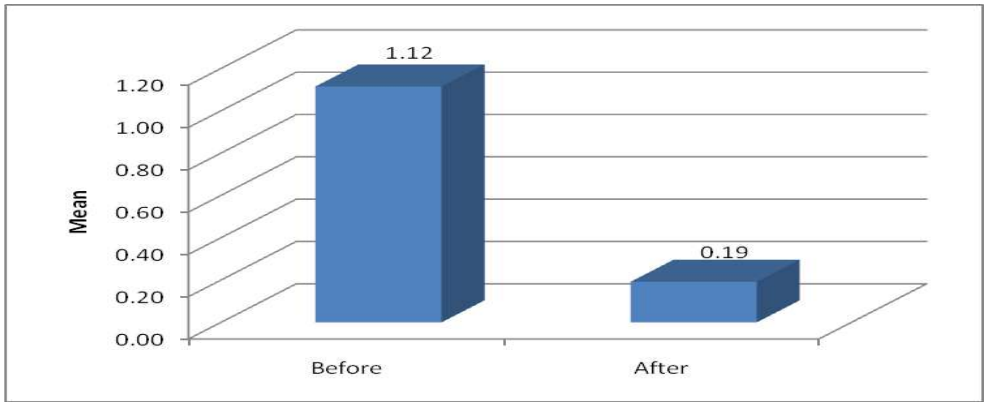


Figure 19 COMPARISON OF PRE-OP AND POST-OP PAIN

14. SURGICAL SITE INFECTIONS

There were no surgical site infections noted in our study.

15. RETURN TO ROUTINE DAILY ACTIVITIES

The patients returned to their routine daily activities at a mean 14 days postoperatively.

16. RECURRENCE

No recurrence was recorded in our cohort at a minimum follow up of 3 months.

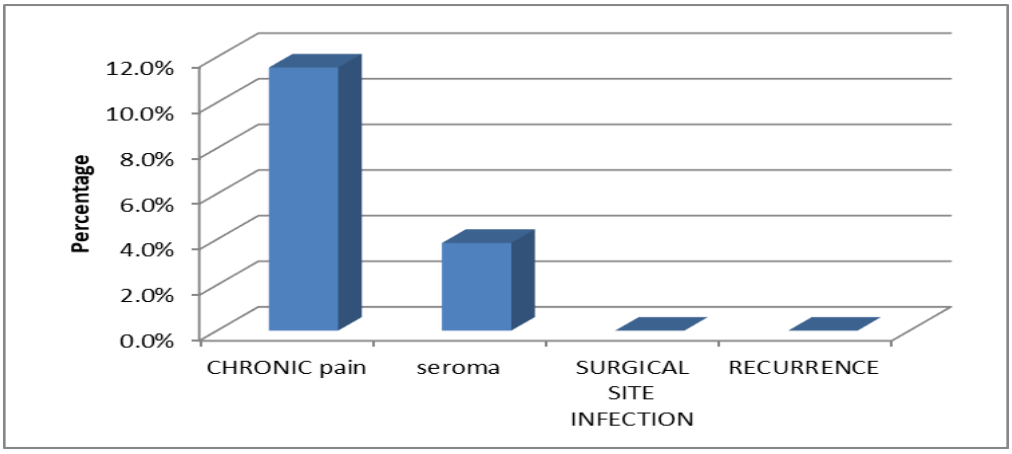


Figure 20 COMPLICATIONS

DISCUSSION

Advantages of laparoscopic approach over the open approach like shorter hospital stay, faster return to routine daily activities, better cosmesis, lesser complications in the form of surgical site infections and post operative pain, decreased recurrence are well known. eTEP is a novel technique for laparoscopic repair of ventral and incisional hernia. It is a modification of the TEP approach in which dissection is performed in the extraperitoneal space and the peritoneum is not entered. Midline crossover of the linea alba in the eTEP approach gives us a wider field for dissection, affords better ergonomics to the operating surgeon and is suitable for patients with short distance between the umbilicus and pubis. The placement of the mesh in the retrorectus space helps in avoiding serious complications like enterocutaneous fistula formation associated with intraperitoneal mesh placement. The extraperitoneally placed mesh is usually polypropylene mesh which is much cheaper than the intraperitoneal dual barrier mesh. In this observational study on 52 patients we describe the age, sex composition, the type of hernia and approach used, intraoperative findings, need for open repair, along with post operative complications like seroma, surgical site infection, length of post op hospital stay, cost effectiveness of the approach and any recurrence after surgery.

PATIENT CHARACTERISTICS

AGE Mean age was 55.19 years, comparable to the mean age of 54.9 years in the study by Belyansky et al, Baig et al had mean age of 54.67 years.[87]

SEX We studied a total of 52 patients of whom 33 were males and rest 19 were females, while there were 79 patients with 34 males and 45 females in the study done by Belyansky et al.[74] Baig et al studied 21 cases with 6 males and 15 females.[87] Radu et al performed eTEP on 60 patients of whom 33 were males and 27 females.[78]

BMI Mean BMI was 26.07 kg/m^2 compared to mean BMI of 31 kg/m^2 in the study by Belyansky et al[74], 28 kg/m^2 BMI in the study by Baig et al.[87]

ASA Median ASA of 2 was comparable to that in the study by Belyansky et al.[74]

COMORBIDITIES

7 Number of patient were diabetic, 8 were hypertensive, one patient had CLD, one patient had history of seizure disorder. Whereas in the study by Baig et al 3 patients were diabetic, 4 hypertensive, one had CAD.[87] 46 % of patients had hypertension and 19 % had diabetes in the study by Belyansky et al.[74]

Smoking history in our study was present in 7 cases(13%). 20 % patients had history of smoking in the study by Radu et al.[78]

HERNIA CHARACTERISTICS

TYPE OF HERNIA

25 out of the 52 cases had incisional hernia and the remaining 27 patients had ventral hernia. In the study done by Radu et al 37 patients had incisional hernia, 21 had ventral hernia, 1 patient had traumatic and 1 had mixed hernia.[78]

REDUCIBLITY

46 patients had reducible hernia (88.5%) whereas the rest 6 had irreducible hernia. Radu et al had 60 % of their patients with reducible hernia.[78]

INTRA OPERATIVE FINDINGS

OPERATIVE APPROACH

In our study eTEP by RS method was performed in 38 cases and by the TAR method in 14 cases. Radu et al did eTEP RS in 38 cases with mean defect width of 5.5 cm and eTEP TAR in 18 cases.[78]

DEFECT SIZE AND AREA

In our study the mean defect size in case of eTEP RS was 4.63 cm whereas in case of eTEP TAR it was 8.43 cm. Mean defect area was 28.46 cm^2 in case of patients operated by the RS approach and it was 44.29 cm^2 in case of patients operated by the TAR approach. Mean defect width in study by Radu et al was 5.5 cm and mean defect area 99.5 cm^2.[78] The mean defect area in the study done by Belyansky et al was 89.4 cm^2.[74]

MEAN OPERATING TIME

Operating time in our study ranged from 100-290 minutes with mean of 169.9 minutes.

Mean operative time was shorter in case of primary ventral hernia by 63.29 minutes as compared to incisional hernia repair.

This is corroborated by study of Radu et al which also had 55 minutes shorter time in primary ventral hernia as compared to incisional hernia.[78] Radu et al also report a difference of 95 minutes in operating time between eTEP RS and eTEP TAR which is statistically significant.

We noticed that the mean operating time went down with increasing experience.

Belyansky et al had a mean operating time of 218 minutes, blood loss of 52 ml and average length of stay of 1.8 days.[74]

Baig et al had mean operating time 176 minutes, range being 138 to 310 minutes.[87]

LENGTH OF STAY

Mean length of stay for RS cases was 3.46 days whereas it was 5.1 days in case of TAR.

Average length of stay in our study was 3.9 days which is less than that of cases operated via open approach or other laparoscopic approaches like IPOM or IPOM plus.

Belyansky et al reported that open AWR patients spent a mean of 5 days in the hospital.[74] Several other large series show hospital length of stay for complex open ventral and incisional hernia repair patients ranging from 5 to 10 days. The mean LOS for eTEP patients was 1.8 days in the study by Belyansky et al; when broken down by Rives Stoppa technique and TAR, the mean LOS was 1.0 and 2.7 days, respectively, highlighting benefits for patients and the current cost-containment environment of health care for both of these procedures.[74]

Park et al in their study had mean stay of 3.4 days in case of lap ventral hernia repair and 6.5 days in case of open hernia repair.

Zanghi et al have shown mean stay of 3.4 days in case of lap hernia repair and 11 days in case of open hernia repair.

Baig et al discharged patients on 2 to 3 post op day. Range 2-5 days.[87]

The short length of stay can be attributed to early patient mobilisation and less pain in the post operative period.

COMPLICATIONS

INTRAOPERATIVE

In our study, only one intraoperative complication (0.18%) was seen, the case had to be converted to open in view of inadvertent enterotomy and it was managed by simple repair of the defect using silk 3 0' suture.

Radu et al reported six (10%) intraoperative complications of which conversion to open was done in four cases - in view of respiratory difficulty in two cases, dense bowel adhesion to mesh in one case and retro-rectus adhesions in one case.[78]

Small bowel perforation was seen in one case which was sutured.[78]

SEROMA

In our study seroma formation was seen in 2 patients which was managed conservatively. Both the cases were operated by the TAR approach, no case of seroma formation occurred in patients operated by the RS approach. There was no case of hematoma formation, deep abscess formation, surgical site infection, port site herniation or wound dehiscence in our study.

Baig et al reported seroma formation in one patient which caused significant pain and discomfort for ten days post op and hence had to be drained.[87]

Belyansky et al reported seroma formation in 3 patients and wound dehiscence in one case, no case of hematoma formation, surgical site infection or deep abscess was seen in their study. Retromuscular seroma was seen in 2 cases, of which one was managed conservatively but other had to be drained by the percutaneous approach.[74]

WOUND RELATED COMPLICATIONS

Wound related complications in our study were seen in 3.8 % cases which is same as the 30 day wound related complications of 3.8% in the study by Belyansky et al.[74]

POST OP PAIN

Pain assessment was done using the visual analog score, ranging from 0-10, 0 signifying no pain, less than 3 being acceptable score and score of more than or equal to 7 being significant pain.

There was significant improvement in preoperative symptoms (p value <0.05). Only 6 patients complained of chronic pain which was mild in intensity and relieved with simple analgesics.

One patient complained of significant pain at one month post op in the study done by Baig et al.[87]

Decreased pain seen after eTEP repair may be because of minimal or no fixation of mesh using tackers. When performing a retromuscular repair, Weltz et al. have recently described that transfascial fixation of mesh is 12-fold more likely to result in chronic pain at 6 months as compared to non penetrating fixation with Tisseel fibrin glue.[63] Perhaps one of the biggest benefits of the eTEP access approach is the use of retromuscular space for placement of large macroporous mesh, thus nearly eliminating penetrating fixation in our cohort

RETURN TO DAILY ACTIVITIES

In our study patients returned to their daily activities by mean of 14 days post operatively as compared to study done by Raftapolos et al return to daily activities was 21 days for laparoscopic ventral hernia repair and 33 days for open ventral hernia repair.[91]

RECURRENCE

There was no recurrence recorded in our study at minimum follow up of 3 months.

Baig et al reported recurrence in one case at a mean follow up of 3 months.[87]

Shakya et al did not report any recurrence in their study.

Readmission

No readmission has been seen in our study till date.

Radu et al reported readmission in two cases, one had small bowel obstruction which had to be managed by laparoscopic surgery and other had hemorrhagic gastritis which was NSAID induced and managed medically.[78]

Belyansky et al reported no readmissions or reoperations at a mean follow-up duration of 322 ± 122 days.[74]

COST

Average cost to the patient operated by the eTEP approach was also less as compared to IPOM approach which uses dual barrier mesh which is expensive whereas the mesh used in eTEP approach is placed in the extraperitoneal space and is much cheaper than the dual barrier biological mesh. Also patients undergoing eTEP repair for ventral and incisional hernia spent lesser time in hospital as compared to those operated by the open approach, required lesser analgesics due to better pain control, thus indirectly lowering the cost to the patient.

SUMMARY AND CONCLUSION

Based on our study on 52 patients who underwent eTEP repair of ventral and incisional hernia at DMCH hospital Ludhiana, beginning from 1st November 2018 till 31st March 2020, on whom relevant routine investigations were performed, we conclude that eTEP is a better and safer alternative than the other hernia approaches as it is associated with a shorter stay, less complications in the form of surgical site infections, early mobilisation, post operative early return to work, reduced cost to the patient as the mesh used is cheaper as compared to the biological dual barrier mesh. All patients were followed for a minimum duration of 3 months post operatively. No recurrence was noted in our study. Chronic pain was seen in 6 patients and it was mild In intensity and relieved with simple analgesics. Perhaps one of the biggest benefits of the eTEP access approach is the use of retromuscular space for placement of large macroporous mesh, thus nearly eliminating penetrating fixation in the cohort. The approach also affords a wider plane of dissection in the extraperitoneal space owing to the port placement and midline crossover so it has also been found to be ergonomically better for the surgeon.

The eTEP laparoscopic repair favours less post operative pain, early post operative enteral feed, decreased incidence of post op surgical site and mesh infection and lesser duration of hospital stay. Faster recovery in laparoscopic repair allows early return to regular activities. Laparoscopic hernioplasty offers better visualization of the swiss cheese defects in ventral hernias and hence better repair. But the approach is associated with a longer learning curve. Overall it a promising technique with good results being seen so far in most of the studies that have been done till now. It has been found to be safe and feasible and associated with less post operative complications and nil recurrence. We conclude that in patients with multiple and recurrent abdominal wall hernias as described in the above cases, this e-TEP approach is a feasible method with the advantages of minimal invasive approach.

This technique provides a previously unaccessed fresh virgin plane of dissection to work in and with techniques like TAR, which reduce the tension in the anterior abdominal wall complex thus making the closure of even large defects possible, providing a large area of a retromuscular plane for placing a mesh and strengthening the fascia with minimal trans fascial fixation. Perhaps one of the biggest benefits of the eTEP access approach is the use of this retromuscular space for placement of large macroporous mesh, thus nearly eliminating penetrating fixation.

Although we should wait for the long-term outcomes, this technique might be the procedure of choice for recurrent incisional hernias with minimal morbidity and low long-term recurrence rates.

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KEY TO MASTER CHART

ASA	AMERICAN SOCIETY OF ANESTHESIOLOGIST
BMI	BODY MASS INDEX
EHS	EUROPEAN HERNIA SOCIETY
N	NO
P	PRIMARY
RS	RIVES STOPPA METHOD
S. NO.	SERIAL NUMBER
T	TRANSVERSUS ABDOMINIS RELEASE METHOD
V	VENTRAL
Y	YES

S.No.	MRD	PATIENT NAME	AGE (YEARS)	SEX	BMI	ASA	VENTRAL/ INCISIONAL	EHS CLASSIFICATIONS	REDUCIBLE/ IRREDUCIBLE	DEFECT WIDTH (CM)	DEFECT AREA (CM2)	APPROACH	OPERATING TIME
1	578168	PS	53	M	24.5	2	V	M3W1	R	4	20	RS	180MIN
2	368691	SK	40	M	28	2	V	M3W1	R	4	24	RS	160MIN
3	591442	SR	53	F	21	3	I	M4W1	R	4	12	RS	135MIN
4	561463	SD	40	F	25.3	2	I	M4W2	R	6	18	RS	190MIN
5	213925	JS	42	M	28.6	1	I	M3W1	R	4	10	RS	120MIN
6	514767	AS	55	M	21.6	2	I	M4W1	R	4	20	RS	110MIN
7	675404	HS	68	M	35	2	V	M2W1	R	3	15	RS	150MIN
8	345873	VPS	62	M	20.7	2	I	M3W2	R	7	21	TAR	130MIN
9	693160	JK	47	F	29.68	2	V	M3W1	R	4	28	RS	125MIN
10	694627	TJ	63	F	32	3	V	M4W2	R	5	50	RS	140MIN
11	420771	RR	53	F	23.5	3	I	M3W1	IR	4.5	22.5	RS	130MIN
12	672898	RG	54	M	22	3	V	m3w1	R	4	18	RS	165 MIN
13	808683	LC	70	M	24	2	I	M2W2	IR	10	50	TAR	210 MIN
14	20387	PK	48	M	23	3	V	M3W1	R	4	40	RS	140 MIN
15	459795	NS	66	M	25	3	V	M3W1	R	4	16	RS	165 MIN
16	84740	VB	69	F	33	3	V	M3W2	R	8	24	TAR	240MIN
17	664033	PK	31	F	27.4	2	I	M3W1	R	4	18	RS	210 MIN
18	735947	KD	68	F	28	2	I	M4W2	R	5.5	27.5	RS	255 MIN
19	39328	HS	73	M	37	3	I	M3W1	R	9	27	TAR	290 MIN
20	746434	AG	49	F	26	1	I	M4W1	R	10	40	TAR	280 MIN
21	810996	RS	53	M	25	2	V	M2W2	R	8	32	TAR	180 MIN
22	873489	HS	58	M	28	3	V	M2W1	R	6	24	RS	155 MIN
23	877781	DS	71	M	35	2	V	M3W1	R	4	16	RS	110MIN
24	756364	RR	43	F	26	2	V	M3W2	R	5	20	RS	165 MIN
25	889650	BS	54	M	31.14	2	V	L2W2	IR	4	16	RS	130 MIN
26	813299	TK	30	F	26.7	2	V	M3W1	R	4	16	RS	150 MIN
27	862326	BD	69	M	24	3	I	M2W1	R	7	28	TAR	190 MIN
28	892583	KK	55	F	25	2	I	M2W1	R	5	35	RS	200 MIN
29	907878	KK	32	M	29	1	V	M4W2	R	7	35	TAR	130MIN
30	909921	SK	53	M	29.4	2	V	M3W1	R	4	16	RS	150MIN
31	910147	KS	40	M	26	1	V	M4W3	R	10	55	TAR	260MIN
32	514406	IC	48	M	31.8	2	V	M3W2	R	5	30	RS	135MIN
33	916670	DJ	42	F	23.4	2	i	M4W2	R	8	48	TAR	210 MIN
34	261641	PS	56	M	21.2	2	V	L3W1	R	5.5	22	RS	100MIN
35	913998	SC	61	F	20	2	I	M3W1	R	4	28	RS	120MIN
36	833232	AM	74	M	24	3	I	M4W2	R	10	60	TAR	260MIN
37	991062	NP	68	M	23.5	3	I	M2 W2	IR	8	56	TAR	310 MIN
38	776320	A	35	F	28	2	I	M3 W2	IR	4.5	22.5	RS	290 MIN
39	887307	SK	79	M	25	2	I	M4 W2	R	6	36	RS	160 MIN
40	901537	KS	55	M	21	2	V	M3W1	R	5	30	RS	190 MIN
41	898401	SG	44	M	26	2	I	M2 W2	R	5	25	RS	198 MIN
42	394672	MK	47	M	23	2	V	M3W2	R	4.5	33	RS	265 MIN
43	913998	SC	58	F	25	2	I	M3 W1	R	6	30	RS	210 MIN
44	261641	PS	56	M	24	2	I	M2 W2	R	5	35	RS	190 MIN
45	223727	YK	47	M	25	2	I	M3 W1	R	4	28	RS	165 MIN
46	890181	KS	75	M	23	3	V	M2 W2	R	8	64	TAR	290 MIN
47	756364	RR	43	F	22	2	V	M3 W2	IR	5.5	66	RS	190 MIN
48	904043	HS	70	M	29	2	V	M2W2	R	8	80	TAR	265 MIN
49	664758	AS	66	M	25	3	I	M3W1	R	5	65	RS	165 MIN
50	904134	DK	52	F	24	2	I	M4W2	R	4	24	RS	190 MIN
51	810312	K	37	F	25	2	V	M3W2	R	6	60	RS	190 MIN
52	811693	NG	48	M	26	3	V	M3W1	R	5	65	RS	210 MIN

S.No.	MRD	PATIENT NAME	LOS	PREOPERATIVE	COMPLICATIONS						RETURN TO DAILY ACTIVITIES (DAYS)
				SYMPTOM	INTRA-OPERATIVE	POST-OPERATIVE	SEROMA	SURGICAL SITE INFECTION	SYSTEMIC COMPLICATION	RECURRENCE	
				PAIN		CHRONIC PAIN					
1	578168	PS	3DAYS	1	NO	0	NO	NO	NO	NO	13
2	368691	SK	3DAYS	0	NO	0	NO	NO	NO	NO	14
3	591442	SR	4DAYS	2	NO	1	NO	NO	NO	NO	17
4	561463	SD	4DAYS	1	NO	0	NO	NO	NO	NO	16
5	213925	JS	3DAYS	2	NO	0	NO	NO	NO	NO	14
6	514767	AS	3DAYS	3	NO	0	NO	NO	NO	NO	11
7	675404	HS	4 DAYS	2	NO	1	NO	NO	NO	NO	17
8	345873	VPS	4 DAYS	0	NO	0	NO	NO	NO	NO	15
9	693160	JK	4 DAYS	0	NO	0	NO	NO	NO	NO	11
10	694627	TJ	3 DAYS	0	NO	0	NO	NO	NO	NO	17
11	420771	RR	5 DAYS	2	NO	0	NO	NO	NO	NO	14
12	672898	RG	2 DAYS	0	NO	0	NO	NO	NO	NO	14
13	808683	LC	3 DAYS	0	NO	0	NO	NO	NO	NO	17
14	20387	PK	3 DAYS	0	NO	0	NO	NO	NO	NO	13
15	459795	NS	6 DAYS	0	ENTEROTOMY	0	NO	NO	NO	NO	16
16	84740	VB	7DAYS	3	NO	2	NO	NO	NO	NO	13
17	664033	PK	3DAYS	2	NO	0	NO	NO	NO	NO	18
18	735947	KD	3DAYS	2	NO	0	NO	NO	NO	NO	18
19	39328	HS	5 DAYS	0	NO	0	NO	NO	NO	NO	13
20	746434	AG	5 DAYS	3	NO	0	NO	NO	NO	NO	14
21	810996	RS	3 DAYS	0	NO	0	NO	NO	NO	NO	16
22	873489	HS	3 DAYS	2	NO	0	NO	NO	NO	NO	14
23	877781	DS	3DAYS	0	NO	0	NO	NO	NO	NO	16
24	756364	RR	3 DAYS	0	NO	0	NO	NO	NO	NO	10
25	889650	BS	3 DAYS	0	NO	0	NO	NO	NO	NO	12
26	813299	TK	3 DAYS	2	NO	1	NO	NO	NO	NO	11
27	862326	BD	4 DAYS	3	NO	2	NO	NO	NO	NO	12
28	892583	KK	4 DAYS	2	NO	0	NO	NO	NO	NO	17
29	907878	KK	5 DAYS	0	NO	0	NO	NO	NO	NO	20
30	909921	SK	3DAYS	1	NO	0	NO	NO	NO	NO	21
31	910147	KS	8DAYS	5	NO	3	NO	NO	NO	NO	17
32	514406	IC	3DAYS	2	NO	0	NO	NO	NO	NO	13
33	916670	DJ	5 DAYS	0	NO	0	NO	NO	NO	NO	16
34	261641	PS	3DAYS	3	NO	0	NO	NO	NO	NO	13
35	913998	SC	4DAYS	0	NO	0	NO	NO	NO	NO	17
36	833232	AM	7 DAYS	2	NO	0	NO	NO	NO	NO	13
37	991062	NP	7 DAYS	0	NO	0	YES	NO	NO	NO	18
38	776320	A	5 DAYS	0	NO	0	NO	NO	NO	NO	13
39	887307	SK	3 DAYS	0	NO	0	NO	NO	NO	NO	18
40	901537	KS	3 DAYS	0	NO	0	NO	NO	NO	NO	15
41	898401	SG	4 DAYS	2	NO	0	NO	NO	NO	NO	17
42	394672	MK	5 DAYS	1	NO	0	NO	NO	NO	NO	16
43	913998	SC	5 DAYS	0	NO	0	NO	NO	NO	NO	18
44	261641	PS	4 DAYS	0	NO	0	NO	NO	NO	NO	13
45	223727	YK	3 DAYS	1	NO	0	NO	NO	NO	NO	15
46	890181	KS	6 DAYS	0	NO	0	YES	NO	NO	NO	19
47	756364	RR	5 DAYS	2	NO	0	NO	NO	NO	NO	15
48	904043	HS	8 DAYS	3	NO	2	NO	NO	NO	NO	18
49	664758	AS	4 DAYS	2	NO	1	NO	NO	NO	NO	15
50	904134	DK	5 DAYS	0	NO	0	NO	NO	NO	NO	18
51	810312	K	5 DAYS	2	NO	0	NO	NO	NO	NO	17
52	811693	NG	4 DAYS	0	NO	0	NO	NO	NO	NO	15

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Date 9/9/19

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.05.2019 has approved the plan of thesis of **Rochan Mangla**, a student of your college for **MS General Surgery** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis

Role of eTEP approach in ventral hernia repair

Supervisor
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The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

SPSingh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
2. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

ROLE OF eTEP APPROACH IN VENTRAL HERNIA REPAIR

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED IN

PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SURGERY

In

GENERAL SURGERY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

November, 2018

Dr. Rochan Mangla

DEPARTMENT OF GENERAL SURGERY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	Role of eTEP approach in ventral hernia repair
For the degree of	M.S. (General Surgery)
Name of the candidate	Dr. Rochan Mangla
Supervisor	Dr. Atul Mishra, Professor, Department of General Surgery, Dayanand Medical College & Hospital, Ludhiana.
Co-supervisor(s)	Dr. Ravinder Pal Singh, Professor, Department of Surgery, Dayanand Medical College & Hospital, Ludhiana.
Co-supervisor(s)	Dr. Amandeep Singh Nar, Associate Professor, Department of Surgery, Dayanand Medical College & Hospital, Ludhiana.
Institution	Dayanand Medical College and Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: The extended view totally extraperitoneal approach (eTEP) is a novel approach for repair of ventral hernia wherein we place the mesh in the retrorectus space instead of intraperitoneal placement. There is rapid and easy creation of extraperitoneal domain with large operative space and flexible port set up and improved tolerance of pneumoperitoneum.

Aim of Study: To study the efficacy, safety, outcome and complications of eTEP approach in ventral hernia repair

Materials & Methods: Prospective time bound study to be conducted at DMCH LUDHIANA, in the department of Surgery over a period starting from 1st November 2018 to 31st March 2020, and will include a minimum number of 20 patients presenting to Department of Surgery, DMCH Ludhiana for eTEP approach repair of ventral hernias.

Clinical Significance: The eTEP approach avoids contact with the abdominal viscera as the mesh is placed in the retrorectus plane thus avoiding serious complications like gut adhesions, mesh migration and enterocutaneous fistula formation seen with IPOM (Intraperitoneal onlay placement of mesh) approach. Large abdominal wall defects can also be repaired by combining this approach with transversus abdominis release procedure.

Keywords: Abdominal wall reconstruction, Enhanced-view totally extraperitoneal technique, Retromuscular mesh placement, Transversus abdominis release, Ventral and incisional hernia repair.

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"ROLE OF eTEP APPROACH IN VENTRAL HERNIA REPAIR"** exist in the Department of General Surgery, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate himself/herself under our supervision and guidance.

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APPROVAL PROFORMA
BY
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DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Rochan Mangla
Department	General Surgery
Topic of Thesis	Role of eTEP approach in ventral hernia repair
Likely date of appearing in PG examination	MAY 2021
Date of enrollment	10th May, 2018
Name of Head of Department	Dr. Jaspal Singh
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1. HOD Pharmacology	1. HOD Physiology
2. HOD Surgery	2. HOD Pathology
3. HOD Pathology	3. HOD Pharmacology
4. HOD Medicine	4. HOD SPM
5. Dean Academics	5. HOD Medicine
6. Vice Principal	6. HOD Surgery
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Approved: Yes / No

Chairperson
Research Committee
Chairperson
Research Committee

Approved: Yes / ~~No~~

Chairperson
Ethics Committee
Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

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2	NAME OF THE INSTITUTE	Dayanand Medical College and Hospital, Ludhiana
3	COURSE OF STUDY AND SUBJECT	M.S. (General Surgery)
4	DATE OF ADMISSION OF COURSE	10th May 2018
5	TITLE OF THE TOPIC	ROLE OF eTEP APPROACH IN VENTRAL HERNIA REPAIR

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Ventral hernias were initially repaired exclusively through open approaches. Since the late 20th century, the laparoscopic approach to ventral hernia repair (LVHR), where a barrier mesh is placed in the intraperitoneal underlay position was described.[1,2] This repair relies on wide mesh overlap, penetrating fixation with tacks and transabdominal stitches without defect closure. The advantages of LVHR over the open approach are obvious which include reduced wound complication rates and faster recovery. With further experience, primary closure of the defect in LVHR was incorporated.[3] The decision of whether to close the primary fascial defect at the time of hernia repair may still be debatable. However, defect closure is becoming popular due to presumed restoration of the anatomy, physiology, and cosmesis of the abdominal wall.[4,5] While the LVHR repair has lasted more than two decades, it has been without disadvantaged which include rare but serious complications like adhesive bowel obstruction, mesh erosion, and enterocutaneous fistula resulting from direct contact between the mesh and the intraperitoneal viscera.[6,7] To overcome these, the transabdominal preperitoneal (TAPP) approach to ventral and incisional hernias was described.[8] This technique has the difficulty of elevating and closing thin peritoneal flaps, a laparoscopic technique which is very diificult to reproduce. Belyansky et al. recently described laparoscopic Transversus Abdominis Release (l-TAR), a reconstructive technique restoring the linea alba with retromuscular mesh reinforcement. Similarly to TAPP repairs, l-TAR prevents direct mesh contact with viscera.[9] Despite initial successes, the

intracorporeal closure of the defects was found to be challenging with traditional port placement lateral to linea semilunaris. The enhanced-view totally extraperitoneal (eTEP) technique was previously described for laparoscopic inguinal hernia repair.[10,11] The advantages of this technique are rapid and easy creation of extraperitoneal domain, large operative space, flexible port set-up, and improved tolerance of pneumoperitoneum. It was designed to facilitate learning and mastering of the procedure for the novel surgeon and for complex cases such as large inguinoscrotal, sliding, or incarcerated inguinal hernias, as well as obese or post-bariatric patients and those with previous pelvic surgeries or a short distance between umbilicus and pubic tubercle.[10,11] This study aims to present a novel application of the Enhanced-view Totally Extraperitoneal access technique for the repair of ventral and incisional hernias.

6.2 REVIEW OF LITERATURE

Belyansky et al retrospectively reviewed consecutive laparoscopic retromuscular hernia repair cases utilizing the eTEP access approach from five hernia centers between August 2015 and October 2016. Patient demographics, hernia characteristics, operative details, perioperative complications, and quality of life outcomes utilizing the Carolina's Comfort Scale (CCS) were included in their data analysis. Seventy-nine patients with mean age of 54.9 years, mean BMI of 31.1 kg/m2, and median ASA of 2.0 were included in this analysis. Thirty-four percent of patients had a prior ventral or incisional hernia repair. Average mesh area of 634.4 cm2 was used for an average defect area of 132.1 cm2. Mean operative time, blood loss, and length of hospital stay were 218.9 min, 52.6 mL, and 1.8 days, respectively. There was one conversion to intraperitoneal mesh placement and one conversion to open retromuscular mesh placement. Postoperative complications consisted of seroma (n = 2) and trocar site dehiscence (n = 1). Comparison of mean pre- and postoperative CCS scores found significant improvements in pain (68%, p\0.007) and movement limitations (87%, p\0.004) at 6-month follow-up. There were no readmissions within 30 days and one hernia recurrence at mean follow-up of 332 ± 122 days.[12]

Baig SJ et al retrospective analysed the data of 21 patients who underwent an eTEP procedure with a minimum follow-up of 2 months. Their data were analysed for operative details, intra-operative and post-operative complications.

For a total of 21 patients, they have recorded a total of two surgical site occurrences (1 seroma and 1 linea alba dehiscence) and one recurrence. One patient had chronic pain. There was no surgical site infection.[13]

Novitsky et al retrospectively reviewed 42 patients with massive ventral hernia beween December 2006 and December 2009. Thirty-two (76.2%) patients had recurrent hernias. The average mesh size used was 1,201 ± 820 cm2 (range, 600 –2,700). Ten (23.8%) patients developed various wound complications requiring reoperation/debridement in 3 patients. At a median follow-up period of 26.1 months, there have been 2 (4.7%) recurrences.[14]

Oprea et al Between November 2014 and July 2016 used Transversus Abdominis Muscle Release (TAR) for Large Incisional Hernia Repair in 24 patients (14 males) with large median ventral incisional hernias. The recurrence in various degrees was present in 18 patients (75%). One patient was with a large median and parastomal left hernia. The average size of the defect was 18,3 cm. in width (12 to 28 cm). The anterior rectus sheath was closed in all patients without one. Five patients (21%) developed various wound complications requiring reoperation (hematoma 3 patients and superficial wound infection without mesh involvement in 2 patients). Follow-up between 2 and 18 months (11, 8 months) without recurrence.[15]

Belyansky et al performed laparoscopic abdominal wall reconstruction for complex hernias in August and September of 2015 on three patients. Operative approach consisted of laparoscopic transversus abdominis components separation, defect closure, and wide mesh implantation in the retromuscular space. Two males and one female with mean age and body mass index of 70 and 30.1, respectively, underwent a mean operation room

time of 329 minutes. Estimated blood loss and length of stay were 91.7 cc and 4.7 days, respectively. No subcutaneous flaps were raised avoiding the need for subcutaneous drains. There were no perioperative complications. All of the subfascial drains were removed prior to patient discharge. On initial follow-up visit at 3 weeks, there was no evidence of wound complications, bulging, or hernia recurrences. They concluded that laparoscopic abdominal wall reconstruction with transversus abdominis release is a unique and feasible approach to complex abdominal wall defects with the potential to reduce pain, facilitate recovery, and decrease length of hospital stay for patients.[16]

Novitsky et al From December 2006 to December 2014, consecutive patients undergoing open AWR utilizing TAR were identified in their prospectively maintained database and reviewed retrospectively. Main outcome measures included demographics, perioperative details, wound complications, and recurrences. Results: During the study period, 428 consecutive TAR procedures were analyzed. Mean age was 58, with mean body mass index 34.4 kg/m2 (range 20–65). Major comorbidities included diabetes (21%), chronic obstructive pulmonary disease (12%), and immunosuppression (3%). Mean hernia defect area was 606 cm2 (range 180–1280) and average mesh size was 1220 cm2 (range 600–4500). The majority of cases (66%) were clean, 26% were clean contaminated, and 8% were contaminated. Eighty (18.7%) surgical-site events occurred, of which 39 (9.1%) were surgical-site infections. Three patients required mesh debridement; however, no instances of mesh explantation occurred. Of the 347 (81%) patients with at least 1-year follow-up (mean 31.5 mo), there were 13 (3.7%) recurrences.[17]

Colavita et al Methods: A prospective, international database was queried from September 2007 to July 2011 for LVHR and OVHR. Carolinas Comfort Scale (CCS) was utilized to quantify QOL (pain, movement limitation, and mesh sensation) preoperatively and at 1, 6, and 12 months postoperatively. Results: A total of 710 repairs included 402 OVHR and 308 LVHR. Demographics were mean age 57.1 ± 13.3 years, 49.6% male, 21.7% recurrent hernias, mean body mass index of 30.3 ± 6.6, and mean defect size of 89.4 ± 130.8. Preoperatively, 56.9% had pain, and 53.2% experienced movement limitation. At 1-month follow-up, 587 (82.7%) patients were provided CCS scores; more LVHR patients experienced pain ($P < 0.001$) and movement limitations ($P < 0.001$). At 6 and 12 months, there were no differences in QOL with 466 (65.6%) and 478 (67.3%) patients responding, respectively. After controlling for confounding variables, LVHR was independently associated with more frequent discomfort [odds ratio (OR) = 1.9, confidence interval (CI): 1.2–3.1], movement limitation (OR = 1.6, CI: 1.0–2.7), and overall symptoms (OR = 1.6, CI: 1.0–2.6) at 1 month. LVHR resulted in a shorter length of stay (LOS) ($P < 0.001$) and fewer infections ($P = 0.004$), but overall complication rates were equal. Recurrence rates were also equal ($P = 0.66$).[18]

Conze J et al selectively searched PubMed for relevant literature using the search terms "incisional hernia" and "randomized controlled trial." 9 RCTs were included in the analysis. The endpoints of the meta-analysis were the number of reoperations, complications, and recurrences. The observed events were studied statistically by correlation of two unpaired groups with a fixed-effects model and with a random-effects model. They analyzed the

quality of life in their own patient cohort preoperatively vs. 1 year postoperatively on the basis of data from the European Registry of Abdominal Wall Hernias. Result: Open surgery and laparoscopic surgery for the repair of incisional hernias have similar rates of reoperation (odds ratio [OR] 0.419 favoring laparoscopy, 95% confidence interval [0.159; 1.100]; p = 0.077). The rates of surgical complications are also similar (OR 0.706; 95% CI [0.278; 1.783]; p = 0.461), although the data are highly heterogeneous, and the recurrence rates are comparable as well (OR 1.301; 95% CI [0,761; 2,225]; p = 0.336). In their own patient cohort in Würzburg, the quality of life was better in multiple categories one year after surgery.[19]

Zuvela M et al Three patients with recurrent incisional hernia due to low-weight polypropylene mesh central rupture were operated 5, 7 and 13 months after initial sublay hernioplasty. The posterior myofascial layer was fully reconstructed in all patients during the hernioplasty, whereas the anterior myofascial layer was only partially reconstructed. The recurrent hernia was managed using heavy-weight polypropylene mesh; in two patients, a new sublay hernioplasty was performed and in one patient an "open preperitoneal flat mesh technique" was performed under local anaesthesia as a day case procedure. If closing of the anterior myofascial layer cannot be ensured during the incisional hernioplasty, the use of low-weight polypropylene meshes should be avoided; preference should be given to the heavy-weight polypropylene meshes.[20]

6.3 AIMS AND OBJECTIVES OF THE STUDY

- To study the efficacy, feasibility, safety and outcome of eTEP approach in ventral hernia repair.
- To analyze the complications, immediate as well as long term, and outcomes; in eTEP repair of abdominal wall hernias.

7. MATERIALS AND METHODS

Prospective time bound study to be conducted at DMCH Ludhiana over a period of 1 year, and will include minimum of 20 patients admitted at DMCH Ludhiana for ventral hernia repair using the eTEP approach, who will then be followed up after an interval of 3 months by ultrasound scan: This is a prospective study to be done at our tertiary care hospital between 1 November 2018 and 31 March 2020. Follow up after discharge will be at interval of 3 months.

7.1 Source of Data

Patients coming to department of surgery at DMCH LUDHIANA with Ventral hernia for repair using the eTEP approach. This prospective study of ventral hernia repair by eTEP approach will be conducted in General Surgery Department of Dayanand Medical College Hospital, Ludhiana during 1st November 2019 to 31st March 2020.

7.2 METHOD OF COLLECTION OF DATA

A minimum total number of 20 cases of anterior abdominal hernias excluding incarcerated, strangulated hernias will be included. Data collection will include a detailed history and a thorough clinical examination. Data will be entered in the proforma, tabulated and analyzed. Patient demographics, hernia characteristics, and perioperative and postoperative data will be analyzed. Main outcomes measured will include perioperative complications, length of stay, 30-day readmissions, and hernia recurrences. Wound and systemic complications will include seroma, hematoma, cellulitis, abscess, skin necrosis, wound dehiscence and mesh infection, ileus ([5 days post-surgery), urinary tract infection (UTI), acute renal insufficiency (ARI), venous

thromboembolism (VTE), respiratory complications (atelectasis, pneumonia, etc.), myocardial infarction (MI), and congestive heart failure (CHF), as well as perioperative complications. The preoperative workup for all hernia patients is standardized at our centers beginning with a detailed history, physical examination, and biochemical studies to assess their baseline health. Specific to this patient population, defect location and size, prior or current wound complications, presence of ostomy, excess skin, and contour abnormalities are part of the physical exam and are considered in selection of the proper operative approach for the patient.

Inclusion criteria:

- Subjects 18 years of age or older.
- All adult patients undergoing eTEP approach repair of Abdominal wall hernia including ventral and incisional hernias, of any etiology.
- Consent to participate in study.

Exclusion criteria:

- ASA class IV or V (severe co-morbid conditions).
- Contra indications for anaesthesia and surgery.
- Complicated hernias (obstructive: strangulated).
- Very large hernia (size >15 cm in transverse diameter)
- loss of domain, ulcerated skin, active mesh infection and fistulae

Given frequent incidence of recurrent hernias, special effort and attention is paid to review of prior medical and surgical records to gain a thorough understanding of their previous interventions, anatomy, and the presence of any mesh or fixation devices. Patients with previous incision extending from xiphoid process to the pubic bone are a relative contraindication to eTEP

access technique and are typically addressed with transabdominal laparoscopic approach. Those with loss of domain and dystrophic or ulcerated skin are also considered to have a relative contraindication for eTEP access approach. Patients with active mesh infection and fistula presence have an absolute contraindication to eTEP and MIS intervention. All other patients are considered candidates for the eTEP access retromuscular approach with or without TAR.

- Inclusion and exclusion criteria will be applied to patients presenting to the Dayanand Medical College Hospital, Ludhiana only.
- Patients will be educated about the study and only those patients consenting to participate in the study will be included. Written informed consent will be taken from every participant included in the study.
- Database collection will include documentation of medical history, age, sex, BMI, pre hospital interval, vital signs, abdominal signs and drug history.
- Routine investigations done for ventral hernia such as Haemogram, RFT, Amylase, Lipase, Chest X Ray, Ultrasound abdomen, (CECT Abdomen will be done if needed).
- Regular monitoring of the patients with haemogram, RFT, Amylase, Lipase, and ultrasound will be done.
- Patients fulfilling the inclusion and exclusion criteria will be taken into the study.
- Stay of the patient in Ward will be noted in days.

OUTCOME: Main outcomes measured will include perioperative complications, length of stay, 30-day readmissions, and hernia recurrences.

Wound and systemic complications will include seroma, hematoma, cellulitis, abscess, skin necrosis, wound dehiscence and mesh infection, ileus ([5 days post-surgery), urinary tract infection (UTI), acute renal insufficiency (ARI), venous thromboembolism (VTE), respiratory complications (atelectasis, pneumonia, etc.), myocardial infarction (MI), and congestive heart failure (CHF), as well as perioperative complications.

Short term:- 1. Conversion rate to open

2. Early complications- SSI

• port site complications

• Seroma/ haematoma

• Bowel complications

3. Need for re-surgery

4. Duration of hospital stay

5. Post – op pain

Long term:- 1. Recurrence at 3 months

2. Seroma/ haematoma

3. Mesh infection

4. Chronic pain

5. Adhesive intestinal obstruction

6. Enterocutaneous fistulae

7. Need for re surgery

STATISTICAL ANALYSIS:

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. All statistical calculations will be done using

SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

Yes, patients presenting included in the study will have to undergo hematological, biochemical, radiological investigations. For this patients included in the study will be informed regarding their inclusion and written informed consent will be taken for all the patients included in the study. These are however, essential from the patient management and are a part of the routine protocol for the management for ventral hernia.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith

8. LIST OF REFERENCES

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PROFORMA

Sr. No. ___

NAME

AGE/SEX

MRD NO

ADDRESS

OCCUPATION

MOBILE

DATE OF ADMISSION

DATE OF SURGERY

DATE OF DISCHARGE

CHIEF COMPLAINTS

HISTORY OF PRESENTING ILLNESS

PAST HISTORY

COPD:

Any History of Surgery

OTHERS:

PERSONAL HISTORY

SMOKING:

ALCOHOL ABUSE:

GENERAL EXAMINATION

VITALS (ON ADMISSION)

HR	BP	RR	TEMP
BMI	Nutrition	Height	Weight
GCS	Pallor	Edema	Icterus
Cyanosis	Lymphadenopathy	Clubbing	JVP

Signature of candidate

Signature of supervisor

SYSTEMIC EXAMINATION

ABDOMEN

INSPECTION

PALPATION

PERCUSSION

AUSCULTATION

RESPIRATORY

CVS

CNS

CLINICAL DIAGNOSIS:

INVESTIGATIONS

Date				
HEMOGLOBIN				
TLC				
DLC				
PLATELETS				
PTI/INR				
B.UREA				
S.CREATININE				
B.SUGAR				
Na/K/CL				
T.BILIRUBIN				
D.BILIRUBIN				
SGOT				
SGPT				
T.PROTEINS				
ALBUMIN				

Signature of candidate

Signature of supervisor

VIRAL MARKERS

HbsAg/ ANTI-HCV/ ANTI-HIV

CHEST X RAY

USG ABDOMEN

OTHERS

OPERATIVE DETAILS:

DATE OF SURGERY:

NAME OF PROCEDURE:

TYPE OF ANAESTHESIA GIVEN:

DURATION OF SURGERY:

INTRAOPERATIVE FINDINGS:

DEFECT SIZE:

CONTENTS:

MESH REPAIR:

NEED FOR OPEN REPAIR:

DRAINS:

INTRAOPERATIVE COMPLICATIONS IF ANY:

POST-OPERATIVE DETAILS:

NEED OF ICU CARE:

DURATION OF DRAIN INDWELLING:

DURATION OF HOSPITAL STAY:

Signature of candidate

Signature of supervisor

POST-OPERATIVE COMPLICATIONS:

DURATION	2 WEEKS	1 MONTH	3 MONTHS
HEMATOMA/ SEROMA FORMATION:			
SSI:			
PORT SITE OCCURRENCE			
BOWEL COMPLICATIONS:			
NEED FOR RE SURGERY:			
MESH INFECTION:			
RECURRENCE:			
CHRONIC PAIN:			
ADHESIVE INTESTINAL OBSTRUCTION:			
ENTEROCUTANEOUS FISTULAE:			

OTHERS:

TIME TO RETURN TO WORK:

OUTCOME:

DAY OF MOBILIZATION:

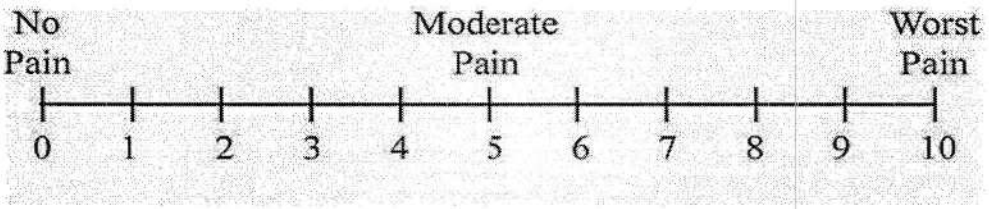
DURATION OF HOSPITAL STAY IN DAYS:

RETURN TO WORK AT POST OPERATIVE DAY:

SEVERITY OF PAIN:

RECURRENCE (YES/ NO):

VAS SCALE



Signature of candidate **Signature of supervisor**

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o..... .....am willing to participate in the study **"ROLE OF eTEP APPROACH IN VENTRAL HERNIA REPAIR"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

.....
Signature of the Witness

Name:

.....
Signature of the patient

Signature of Candidate

Signature of Supervisor

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य **"ROLE OF eTEP APPROACH IN VENTRAL HERNIA REPAIR"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"ROLE OF eTEP APPROACH IN VENTRAL HERNIA REPAIR" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ